THE

Practical Teacher

A MONTHLY EDUCATIONAL JOURNAL

Edited by JOSEPH HUGHES.

'*Knowledge is proud that he has learned so much,*
Wisdom is humble that he knows no more.'—COWPER.

VOL. V. No. 4. JUNE, 1885. { PRICE 6D. / POST FREE, 7½D.

Hygiene.

BY ALFRED CARPENTER, M.D., M.R.C.P. (LOND.),
Chairman of the Council of the Sanitary Institute.

SHELTER AND WARMING—(*continued*).

Fireplaces, Stoves, Grates, etc.—The object to be attained by a fireplace or stove is the distribution of available warmth. Fuel is burnt and warming appliances are used for the purpose of setting free the heat which is latent, or which may be extracted from fuel by the oxidation of its contained carbon. The heat is diffused by three different ways—radiation, conduction, and convection; any principle of warming which neglects to consider all these ways for diffusing heat will be faulty, and more expensive than it need be.

Radiation comes into play on all occasions. A heated body gives out heat in all directions until a mean is reached; just as a lamp gives light, so a fire or a heated body gives out heat on similar principles and in consequence of similar laws. Light may be intercepted or turned in another direction; so heat may be absorbed or have its course deflected from a straight line. There are some definite laws as to radiant heat, such as its power being directly proportional to the temperature of its origin, and inversely as to the square of the distance. The angle of reflection is also equal to the angle of incidence. Like to light, heat may be absorbed, obeying a defined law; absorption being influenced by the colour of the absorbing body. Space will not, however, allow me to dilate more fully upon the laws of heat in this place. The principle upon which conduction is based must be thoroughly understood by those who are studying the subject of warming and ventilating; whilst the principle of convection is an important property, which must be thoroughly appreciated to understand the correct application of hot-water apparatus. Radiation can be carried on in vacuo. In a perfect vacuum it alone of the three is possible. Conduction cannot take place if there is no conducting medium, and convection takes place because the lighter particles in fluids rise above those which are heavier; and as the consequence of the absorption of heat is to enlarge the area of the atom, it becomes lighter as soon as heat is imparted to it. The upward tendency in the air, which may be noted upon the roof of a house on a hot summer's day, is produced by convection. The rise of the particles of the air, which may also be observed issuing from a furnace chimney when the fire is brisk, is also due to the same cause. It is this principle which carries up the smoke of a city above the tops of the houses, and it is also the main principle which regulates the currents in hot-water pipes when used for warming purposes. The fashion of our fireplaces and the customs of our people in their kitchen arrangements have much to do with the production of smoke. It is quite possible to prevent nine-tenths of that which is produced by common fires, if a little care could be used. If smoke was prevented, the consumption of fuel would be diminished by thousands of tons every day, and the quantity of heat at command would be correspondingly increased. An ordinary fireplace allows of an immense waste of fuel; also an immense waste of heat by convection. Common grates also assist to conduct away in the wrong direction much of the heat which remains, so that the construction of a grate may conserve only a tenth part of the heat for useful warming purposes. Furnaces ought never to be allowed to smoke. There are easy means by which smoking chimney-shafts may be entirely prevented, the great principle being that the air shall enter the furnace and carry the smoke (which is produced when the fire is fed) over the live coals in such a way that the carbon is completely consumed before it gets from the fire into the draught of the chimney. There are various kinds of smoke-consuming doors provided by different boiler-makers; but the principle is the same in all: the only difficulty is to make the fireman shut the furnace doors as rapidly as possible after priming the furnace with fresh fuel. Smoke doors are not sufficient if the stoker is careless.

It will be difficult to persuade the Englishman to give up the luxury of an open fireplace; it has become so much a part of his domestic life that it would probably lead to serious political disturbance if the sanctity of the domestic hearth should be invaded by prohibition of smoke-making fireplaces. The privilege of poking the fire at the owner's will will never be surrendered by our countrymen, and

BRITISH MUSEUM

a certain amount of smoke will always result from this confirmed habit. I think it is a luxury which ought to be paid for, and if a man pollutes the atmosphere with unconsumed coal-smoke he should pay a penalty in the shape of a heavy tax, which should go into the coffers of the local authority in reduction of local rates. The tax should not be levied when the fireplaces are so constructed as to be smokeless, or when gas is used as a warming agent. A gas fire may be so arranged as to simulate an ordinary coal fire. There are two or three kinds of asbestos clinkers, which, when well laid over properly protected Bunsen burners, afford a fire which is equal in appearance to the most desirable coal fire, without the production of any smoke, and without it being possible to perceive any difference in the room itself. It is necessary that there be a very good draught, and that air be freely admitted in close proximity to the gas-burners, so as to avoid the chance of the production of a heavy gas named acetylene, which is very offensive in character, and which is always manufactured if there is not sufficient draught, or when pressure of gas is too great for perfect combustion. This form of fire should have a fireplace constructed with fireclay at the back and sides, instead of the iron which is but too usually introduced. The heat from such a fire is capable of diffusion by radiation in the most complete manner throughout the room, and loss by conduction in the wrong direction is obviated; but at the present price of gas its use in London is about double the cost of coal, but there is an immense saving on the absence of dust and the diminished labour to the house-servants. Six or seven gas fires in a house will lessen the domestic work to the extent of a pair of hands, and the damage which the smoke and dust of coal fires ordinarily produces is altogether prevented. The use of gas for cooking purposes is much on the increase. The cooking-stoves now let out by most gas companies at a moderate charge, if they were to become still more general, would materially assist to keep the atmosphere of our great towns clearer, and cause a financial saving to the housekeeper. The products of combustion must, however, be carried off in all cases. All stoves which are not provided with chimneys are highly dangerous, and should never be permitted to be used. They must poison those who submit to their influence in the long run. The chimney-shaft may be utilised for warming other parts of the house, and advantage is sometimes taken of its power to give off heat by radiation and conduction as it passes through rooms in upper storeys; but care must then be used that no products of combustion shall escape into the apartment which is so warmed. If smokeless fire-places, gas fires, and cooking by gas could become general, a wonderful alteration might be effected in the architectural appearance of the roofs and higher parts of our town houses. It would be indeed a relief to get rid of those extraordinary and weird-looking objects which are thought to be necessary to cure smoking chimneys, and which seem to people the roof tops with the most extraordinary shapes and figures which human ingenuity could possibly devise, and which are, after all, only stopgaps and not remedies. There are various forms of stove which are in common use, in which an attempt is made to diminish or do away with smoke. The so-called slow-combustion stoves, in which the coal or coke is introduced so that the smoke must pass through the live coals, are good specimens. There is moderate draught, and fireclay enters largely into their formation. Such are those which are manufactured by Doulton and Co., Barnards, of Norwich, General Gas Heating and Lighting Apparatus Company, and some twenty others, which were exhibited last year (1884) in the East Arcade at the Health Exhibition. In all cases the smoke is consumed by compelling it to pass through the live coals before the products of combustion can pass away into the chimney-shaft. In some patented stoves the air is heated and passed into iron cylinders, which give off the heat in the apartment to be warmed; but the heat which has passed through iron is not so comfortable to the feelings as that which is obtained by radiation from an open fire: so that stoves are never likely to banish the open fireplace from our private rooms in this country unless the price of coal should rise, so as to prohibit the waste of heat which does now take place as the result of that kind of warming. An attempt is sometimes made to overcome the difficulty by placing trays containing water in contact with the stove, by means of which the heated air is rendered moister; it is less irritating than a dry heat, but it is found impossible in practice to regulate the supply of vapour. Servants are thoughtless; the air is at times made so moist that iron ornaments are rusted by the warm moist air, whilst at others the water is found to have evaporated, and then the dry air is more unbearable in contrast with its former dampness. These kinds of stoves —such as the 'Gurney,' in which a trough containing water is below the line of heat—require much care on the part of the attendants, and easily come to grief if they are not intelligently supervised. They are very serviceable, if well cared for. Want of intelligent supervision is the cause of failure in most of these kinds of appliances; and as those who have to attend to fireplaces are not drawn from the most intelligent classes, it comes to pass that any successful plan of warming must be simple, and must not require the exercise of too much skill in its management. The late Dr. Siemens introduced a combination of coke and gas, which is simple in its arrangements and satisfactory as far as it goes; but it is not equal to gas alone, because dust is an accompaniment, and labour is not economised to the same extent. There are some principles which must be kept in mind in arranging for the diffusion of warmth. A black surface absorbs and radiates very rapidly, whilst a white surface reflects much and absorbs but little; dark surfaces are therefore warmed more easily than white walls. Polished metal surfaces reflect heat, and absorb but little; all steam pipes, engine-fittings, and all things in contact with heat, must be kept well polished, as they do not get hot so rapidly; but boilers, tea-kettles, and all other cooking utensils should be black and rough, so as to conserve heat and preserve it for use. An old tea-kettle which has a crust of soot upon its bottom may be taken off the fire when the water is boiling within it, and it may be held upon the palm of the naked hand without any mischief resulting to the experimenter, because the rough soot is a bad conductor, and the heat in the water passes upwards (and not downwards) by convection. The custom of white-washing the roofs of houses in hot summers has its use in consequence of the laws regarding radiation.

The heat from stoves and fireplaces is required not only for warming the air of the rooms, but also for keeping up the warmth of the walls. If the walls are allowed to get cold, the consumption of fuel for warming purposes must be much greater than when the walls are kept nearer to the temperate level. It happens, therefore, that a slow-combustion stove, kept alight all night in the basement of the house, by preserving an equable temperature in the rooms, and preventing the walls from being chilled by upward draughts of cold air, will lead to a great saving, by diminishing the demand for larger fires at break of day.

It is always best to keep a close stove as near to the middle of the room as can be possibly arranged. This is not a possible plan with open fireplaces, because of the difficulty of establishing a draught, and so preventing the discharge of the products of consumption into the room itself. An open fireplace should be so placed that it may command the larger part of the room, so as to give off heat by radiation to the largest area. A fireplace should always be at the narrowest or shorter side, not the widest end or longer side of the room. The great difficulty in the use of an open fireplace is that which arises from the irregular diffusion of heat. Those in front of the fire are scorched; those out of the limit of radiation may be chilled, especially if the walls of the room have been allowed to get cold. For these and other reasons, close stoves, and warming by means of the circulation of hot water are more thorough, and the heat is capable of being directed more equally than can be possibly the case with the open fireplace; whilst smoke, dust, and soot are materially diminished. Smoke and soot are evidences of imperfect combustion. This may be seen in all houses in which open fireplaces and naked gas-burners are used. The destruction of property which arises yearly in consequence of imperfect combustion of coal and gas is something enormous; it is submitted to as if it was inevitable, whilst the exercise of a little forethought, and some first outlay in arranging the plan of warming and lighting, might obviate the major part of the whole. Open stoves should burn the fuel completely, but slowly. The slow combustion is secured by having a solid bottom to the grate, or with only small openings which may be closed when the fuel is fully alight. The throat of the chimney should also be small, so as not to give rise to an unequal draught; and the interior of the shaft of the chimney should be perfectly smooth, and so straight as to minimise the friction, and leave no place for stagnation in any part of its course. One reason why chimneys get foul so rapidly is that the bricklayer takes no note of the interior of the chimney, not caring to take the trouble to smooth off the mortar or to point the joints in the brickwork; the minute saving in labour being effected at the cost of a chimney which rapidly fouls, and, as a consequence, soon becomes smoky.

(To be continued.)

—o—

The New Class-Subject, 'Elementary Science.'

(What to teach, and how to teach it.)

BY RICHARD BALCHIN.

(*Continued from page* 100.)

IN last month's article I explained that the syllabus for one year's course of lessons in this subject for Standards VI. and VII. should include practical science work of an elementary nature. I also described the kind of 'school workshop and chemical laboratory' which, it appears to me, should form an adjunct to every large school throughout the country.

Two lessons per week, of three-quarters of an hour each, are at least necessary. They should be the last lessons in the afternoon, so that, when needed, the work may go on until, say, five o'clock. In the case of such a subject as practical chemistry, it is manifestly impossible to fix the minute at which work shall stop; neither is it necessary to do so with our oldest boys. There is certainly no anxiety on *their* part to leave school at the official time; indeed, my difficulty has been to get the boys to stop work and go home to tea. 'In the eager pursuit of knowledge,' Confucius 'forgot his food.'

The following is a syllabus of a year's course of lessons in 'Elementary Science' for Standards VI. and VII. This scheme may also be adopted as the second stage in the specific subject, 'Chemistry.'

LESSONS I. AND II.

The decimal system of weights and measures. The metre, litre, gram; their divisions and multiples. Each boy to make, in the shop, a metre measure, divided into decimetres. Also to make a table of those weights and measures to hang up at his bench. The two-pound tins in which the American 'leaf-lard' is sold hold almost exactly a litre of water, etc.

LESSON III.

The 'gram' and exercises with the balance. The boys to weigh out various small objects, and to express the results on paper in 'grams,' or their divisions and multiples. A balance, with metric weights, should be kept in the laboratory. Unfortunately, the boys have now to *un*learn all they learnt about our foolish system of weights and measures while in Standard IV. What a cruel waste was that of precious time!

LESSON IV.

The centigrade thermometer: freezing point of water, 0°; the boiling point 100°. The ordinary thermometer must now be ignored. Another instance of *un*learning! The boys to perform twelve exercises in taking temperatures, recording the results in their exercise-books.

LESSON V.

Laws of chemical combination. First law: 'The same body is always composed of the same elements, united in the same proportion.' Instances.

LESSONS VI. AND VII.

Laws of chemical combination. Second law: 'When an element unites with another in different proportions, the higher proportions are invariably multiples of the lowest.' Third law: 'If two bodies,

A and B, separately combine with a third body, C, the proportions of A and B which unite with C are measures or multiples of the proportions in which A and B combine together.' Numerous examples should be given. Each boy should write out these laws and hang the card near his bench.

LESSON VIII.

The theory suggested to Dalton when these laws were discovered, viz., the 'atomic theory.' The boys should now write on a small card the atomic weights of about twelve elements, and hang the card near their bench, or commit the numbers to memory. (Note.—In my detailed notes of these lessons, I will explain a system of 'mnemonics' by which these and other sets of numbers may be artificially fixed in the memory.)

LESSON IX.

'A theory': its meaning and its relation to the demonstrated facts which the 'theory' appears to explain. Instances in which what was at first a theory turns out to be a fact. More exercises on atomic-weight numbers and combinations.

LESSONS X. AND XI.

Glass tubing: its manipulation. Exercises for the laboratory. Bending tubes to various angles, according to a half-circle scale. Making syphons. Pointing tubes. Cup-tubes, etc.

LESSONS XII. TO XV.

The blow-pipe. Its uses. Exercises in the laboratory: (*a*) Rounding off ragged edges; (*b*) hermetically sealing; (*c*) joining; (*d*) making bulbs, etc.

LESSON XVI.

The construction of a Liebig's condenser. Boys to prepare for future use a bottle of distilled water. Other experiments.

LESSON XVII.

Test-tubes. The boys to make in the shop a test-tube stand, holders, supports, etc.

LESSONS XVIII. TO XX.

Infusions and solutions. Distinguish between these. Boys to make an infusion of red cabbage, and then some blue test-papers. Prepare a bottle of starch water from a raw potato; also a bottle of iodine solution.

LESSON XXI.

Solutions. Various solutions to be made by the boys, put in bottles, and labelled—*e.g.*, plumbic nitrate, potassium iodide, mercuric chloride, ammonium sulphide, etc.

LESSON XXII.

Filtrates. Boys to prepare filtrates from the combination of the solutions already prepared. To dry the filtrates, put the powder in small pill-boxes, and properly label.

LESSON XXIII.

Chemical compounds. Binary compounds; meaning. Calcium oxide. Sodium chloride. Hydrogen sulphide. Magnesium iodide, etc. Meaning of the terminations 'ide,' 'ous,' and 'ic' in binary compounds, thus: Ferrous chloride and ferric chloride, mercurous oxide and mercuric oxide.

LESSON XXIV.

Binary compounds. Use of the prefixes 'mono,' 'bi,' 'di,' 'tri,' etc. Carbon bisulphide (CS_2), etc. Sulphur dioxide (SO_2), trioxide (SO_3). Carbon monoxide (CO), carbon dioxide (CO_2), etc.

LESSONS XXV. TO XXVII.

Preparation of oxygen from (*a*) potassium chlorate; (*b*) manganese dioxide; (*c*) mercury oxide; (*d*) potassium nitrate (=common nitre). Each boy to prepare four jars of the gas, and perform four experiments; to record in his exercise-book the work done, under these headings:—(1) How I prepared the gas. (2) What experiments I performed with it. (3) What these experiments proved.

LESSON XXVIII.

Preparation of carbon from a few splinters of wood, in an iron retort. Boys to record in grams, (1) the weight of wood when placed *in* the retort; (2) the weight of carbon (charcoal) obtained; (3) explanation of the difference. Each boy to prepare, for future use, two bottles, (1) of fragments of carbon, (2) of powdered carbon.

LESSON XXIX.

Preparation of lime. Fragments of white marble to be calcined in the iron retort. Weight in grams when introduced. Weight of lime obtained. Explanation of difference. Each boy to prepare two bottles; one of fragments of white marble, the other of the lime obtained by calcining the same.

LESSON XXX.

Preparation by the boys of a large bottle of lime-water. A portion of the lime already obtained to be slaked (*i.e.*, hydrated), then mixed up with water and allowed to settle, the clear supernatant liquid to be syphoned off. While settling, the boys can write rough notes of the operation; note the difference between a mixture and a solution; meaning of a saturated solution, etc.

LESSONS XXXI. AND XXXII.

Preparation by the boys of hydrogen from sulphuric acid and zinc. This must be done under the careful supervision of the teacher. Explanation of the operation to be written. Experiments: record of the whole under headings similar to those adopted in the case of oxygen.

LESSON XXXIII.

Boys to burn a fragment of carbon in a jar of oxygen, to form carbon dioxide. Tests, and explanation.

LESSON XXXIV.

The construction of the apparatus for showing the action of the exhaled air from the lungs upon lime-water. Each boy to make a similar apparatus for his own use.

LESSON XXXV.

Experiments with the apparatus constructed in the last lesson. Weight in grams of the lime-water in the bottle before breathing into it; the weight afterwards. Explanation of the increase. Compare with the *loss* of weight suffered by the white marble when calcined, as described in Lesson XXIX.

LESSON XXXVI.

Preparation of carbon dioxide from fragments of white marble and hydrochloric acid. Each boy to prepare three jars of the gas, to perform three experiments, and to record the results, as in the case of oxygen.

LESSONS XXXVII. AND XXXVIII.

Chlorine. Its preparation, by gently heating a mixture of common salt, manganese dioxide, and sulphuric acid. Boys to prepare two jars of the gas, perform experiments, and record the results.

LESSONS XXXIX. AND XL.

The combustion of a candle. Each boy to construct the entire apparatus for showing and collecting the whole of the products of such combustion, and to write a complete explanation of the process.

Such is the syllabus which, it appears to me, may well be gone through with boys in Standards VI. and VII. I should like it to be understood that my aim in this scheme is not to prepare boys to pass any particular examination, but rather to attract them to the science, and guide them in the first two or three infantile steps along the pathway. To many teachers, this syllabus may seem absurdly elementary; but I am convinced that if much more were attempted, the boys' interest and zeal would not be awakened, and they would be less likely to pursue the subject further when they left school. As in the case of the lower standards, I propose, in my future articles, giving detailed notes of the lessons in the scheme which I have now submitted to my readers.

(*To be continued.*)

—o—

How to Teach Drawing in Elementary Schools.

BY T. R. ABLETT,

Superintendent of Drawing to the School Board for London.

Section IV.—1. *Simple Solid Geometry or Orthographic Projection.*

PLANE geometry deals with figures which have length and breadth only. Solid geometry represents, with the same accuracy, objects which have thickness as well as those which have length and breadth. Strictly speaking plane geometry is but a branch of solid geometry, since its scope is confined to the representation of plans of figures having two dimensions in one plane.

Solid geometry is the fountain from which springs machine drawing, architectural drawing, and the other forms of the graphic language of the workshop. This is a universal language; the only one in which an interchange of ideas can be made between workmen of different nationalities who cannot understand a foreign tongue. It is a medium by which we can communicate our ideas or wishes to a skilful workman in a way that will enable him to produce the article we require without the necessity of personal instructions.

When children have been led to understand these practical bearings of the subject it will be found quite easy to interest them in the acquirement of its simple principles. Practically I have found them show more interest in this work than in that of plane geometry. Much depends, however, on the method of giving the instruction. It is a great gain to know when to stop in making an explanation. Sometimes a teacher may be heard to give a demonstration quite sufficient for the purpose, and *then* to supplement it by a rigmarole which confuses that which was at first made clear.

It is well to show practically the nature and position of the intersecting planes. This may be readily done by slitting two large oblong pieces of stiff paper, as in Fig. 1, and by placing them together so that their centres *x* coincide as in Fig. 2.

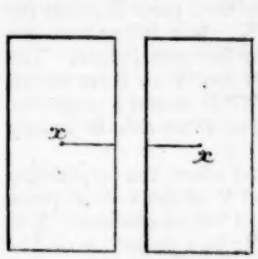


Fig. 1.

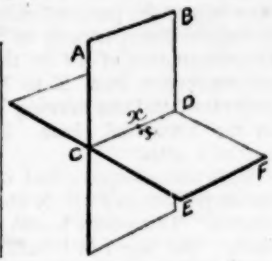


Fig. 2.

Remember to point out that only a portion of the planes are represented by the pieces of paper, and that they are of unlimited extent. The upright one is termed the vertical plane and the other the horizontal plane. A plane is a perfectly level surface, like the top of a pool of tranquil water. All planes that are in the same direction as the top of the pool are horizontal planes. Those which stand straight up, or perpendicular to horizontal planes, are vertical planes.

In representing a solid object two drawings of it are executed, one on the vertical plane and one on the horizontal plane. To show how these drawings are made, two portions of the vertical and horizontal planes lettered AB, CD, EF in Fig. 2 should be taken. They may be represented by two small black-boards hinged together, or by two pieces of cardboard hinged together by pieces of tape or calico pasted at the back and front of the junction, or as it is termed, the intersecting line. Having placed the two planes in position, bring the object between them, fix it in a certain position, and proceed to show how the two drawings are made.

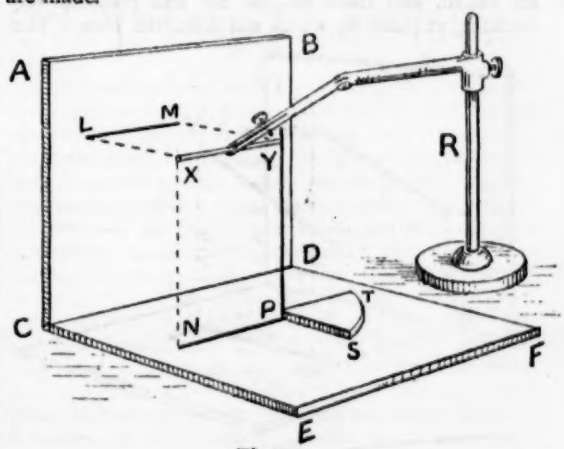


Fig. 3.

In Fig 3 the method of giving a first lesson is shown. Instead of a solid, a straight line XY is placed in a

fixed position by means of a stand R. The line is parallel to both planes. The line between Y and P represents an iron rod fastened to a triangular piece of wood, PTS, so that it will stand perpendicular to the surface on which the piece of wood rests. This little piece of apparatus is a kind of set-square, and thus I will describe it. By placing the rod of the set-square against Y the point of the triangle at P shows where a perpendicular drawn from Y to the horizontal plane meets it. Mark the point P. With the set-square show where the perpendicular from point X meets the horizontal plane, namely in N. Join NP and we get a representation of XY on the horizontal plane. The perpendiculars from X to N and Y to P are named projectors, and the drawing NP is named a projection on the horizontal plane. For short, this is usually termed a plan.

With the set-square find out where the perpendiculars or projectors from X and Y to the vertical plane meet it. The points L and M will be obtained. Join them. The line LM is said to be a projection on the vertical plane, or, for short, an elevation.

As a second example, place the rod XY in a position perpendicular to the horizontal plane and parallel to the vertical plane, as in Fig 4.

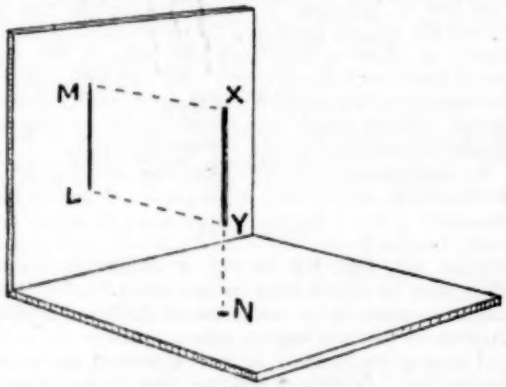


Fig. 4.

The rod of the set-square will touch XY throughout its length, and there will be but one projector terminating at point N, which will form the plan. The

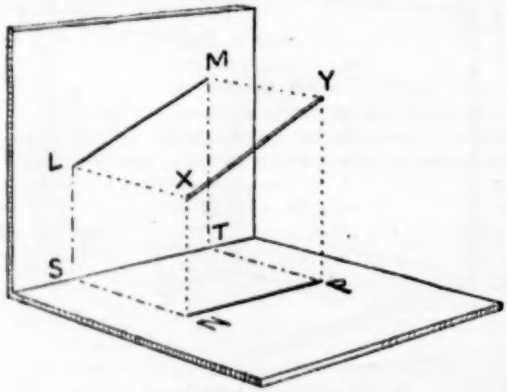


Fig. 5.

set-square will give two projectors to the vertical plane, terminating in M and L respectively. Join ML, and we obtain the elevation of XY.

As a third example, place the rod perpendicular to the vertical plane and parallel to the horizontal plane. The elevation will be a point and the plan a line.

In the next place show how it is that the plan and elevation are sometimes represented by lines shorter than the line which is being drawn.

In Fig. 5 the plan NP is shorter than XY, but the elevation LM is the same length, because XY is parallel to the vertical plane. If XY is placed obliquely to both planes, both the plan and elevation will be less in length than XY.

When the children have quite grasped these simple principles by seeing each drawing made practically, the rod may be held in various positions between the two planes, and they may be required to say what will be the character of the plan and elevation in each case, as in Fig 6, where a rod six inches long is used throughout.

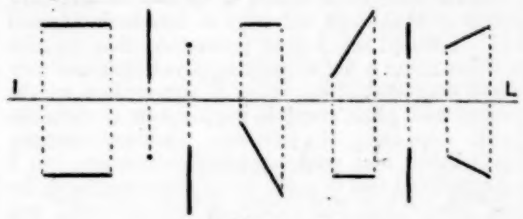


Fig. 6.

In Fig. 6 the plans and elevations are shown on one piece of paper. IL represents the intersecting line, or line where the planes meet. The portion above it represents the vertical plane, and that below the horizontal plane. The dotted lines on the vertical plane represent the projectors drawn to the horizontal plane, as LS represents XN and MT represents YP in Fig. 5. The dotted lines on the horizontal plane represent the projectors drawn to the vertical plane, as SN for LX and TP for MY in Fig. 5.

This should be carefully explained to a class, and may easily be done by swinging the two pieces of cardboard into one plane after each drawing, so that the crack between them will represent IL in Fig. 6.

The North of England School Furnishing Company manufacture two black-boards hinged together with arrangements which hold the boards at right angles for the drawing to be made, or fix them in one plane as in Fig. 6.

The rate of progress of the scholars will depend very much upon the grasp they get of the simple principles already considered. Two or three lessons will not be thrown away on this part of the work. Plane figures and rectangular solids may be dealt with in the same way. Fix the object between the two planes and find the leading points of the plan and elevation with the set-square. When each drawing is complete, move the boards into one plane and show the plan and elevation on one surface. After each figure is demonstrated by the teacher it should be drawn by the scholars. The following order of dealing with the models may be observed:—Square, cube, rectangle, prism, with square or rectangular end (brick), triangles, polygons, circle, and ellipses.

The sections of such solids as the cube and prism with a rectangular end do not present much difficulty. The great thing is to show the pupils the actual shape of the surface exposed in cutting the section. Trace this shape on paper and draw the plan or elevation of

the cut-out shape without reference to the solid. When the pupils understand how to deal with the section by itself they will find no difficulty in representing it in connection with the solid.

Soft clay may be used to make a model of a cube or prism. This can be cut with a large knife, and the exposed surface shown to the class and then traced by applying it to the paper and running a pencil round its outline. For constant and ready use small wooden models (solid and of soft material) may be cut in various pieces, rightly attached, and parted or severed in that particular direction which will show the section required.

Circular solids, like the cone, cylinder, pipe, and sphere, should be dealt with after the prisms and pyramids, which have a triangular or polygonal end. The French sometimes use skeleton models made of wire for the higher geometrical work. By means of these the development of the cone from a right-angled triangle and the cylinder from a rectangle, and the like, are shown by revolution. Skeleton models, to some extent, help to show the nature of sections.

2. *Simple Scales.*—In these it is not advisable to include the scale of chords or the diagonal scale, which are scarcely required by young people. Simple scales will present little difficulty if good instruction has been given in drawing to scale by the methods indicated in former articles, and in connection with the Solid Geometry.

It is a most useful practice to provide a drawing with no scale marked on it and to require the pupils to discover the scale from the distances or measurements figured on it.

Model Drawing will form the subject of the next article. *(To be continued.)*

—o—

How to Teach History.

BY ISABELLA LANDALE.

(Continued from page 59.)

STYLE OF TREATMENT.

IN the style of relation lies, perhaps, our greatest difficulty; it is a stumbling-block which lies at the threshold of all teaching, for few are gifted with sympathetic imagination powerful enough to enable them to enter into the feelings of such an audience, or with sufficient literary skill to adapt their language to the comprehension of a child. To do this thoroughly would require genius, and to secure the services of genius for such a work as we describe, public opinion must be roused to a sense of the dignity and importance of the subject. If the attention of our Committee of Council on Education could be attracted to this matter, the way would be clearer before us, and we might hope through them to obtain the co-operation of many great minds in the work of moulding the moral conceptions of the young. No mere love of fame or worldly distinction could rival the attraction which such a field of usefulness would present to worthy men—a power for good of even wider influence than that of Dugald Stewart, of whom it is recorded that his eloquence had 'breathed the love of virtue into whole generations of pupils.'

A good test of the comprehensibility of any such stories would be to try, before presenting them to a class, if they are thoroughly understood by children with whom the writer is on familiar terms. Their effect might first be tried on his own children; as Molière was accustomed to read over his plays to his old nurse, and submitted nothing to the public which was beyond her comprehension.

The great desideratum in the language employed is not so much the simplicity of the individual words used, as simplicity in the structure of sentences—a point which is very clearly brought out by Dr. Currie,* who also quotes Isaac Taylor's opinion that an occasional use of words which are a little beyond them is useful as helping to extend the children's knowledge of language and range of ideas. Bain also advocates this 'tentative and inductive process,'† by which the pupils gradually gather from the context the meaning of unfamiliar terms; however, care must be taken that the meaning is perfectly clear.

A childish style is the very last to attract a child, who scorns to be treated as 'a little thing'; indeed, it is wonderful what an influence is gained over children by avoiding the *de haut en bas* tone, which adults are so apt to use in their intercourse with the young. Nothing pleases a child more than being treated as a rational and intelligent being, which, if treated thus, he will soon prove himself to be.

Besides simplicity in the structure of sentences, it is advisable—at any rate, during the first six months—to use Saxon words as much as possible, not so much because they are simpler, but because they call up images much more effectually than language which expresses a more advanced stage of national thought. Saxon words, having been formed directly from the things they represent, have a suggestive power which is wanting in the more abstruse words which have a Latin origin.

MEANS OF EFFECTING THE DESIRED END.

Supposing, then, that the teacher possesses a store of such simple, clear, and vivid pictures of noble men and noble deeds, the next point to be considered is the best way of ensuring the effect intended.

The suggestions made in the last section, as to the forming of impressions and ascertaining the child's grasp of them, will again be useful here. Special attention should be paid to the help afforded by geography in giving a feeling of reality to the stories, and adding 'a local habitation' to the child's conception of the hero, and thus making him more than a mere 'name.'

The mode of treatment in the two sections is the same, and, as hinted, would likely be blended in one course; the only fresh element we have to consider being the moral impression. We think this would be best engraved on the pupils' minds by avoiding the appearance of direct moral teaching, which has little or no effect if the child begins to suspect anything like preaching. It is in the unconscious influence of example that its greatest power lies. Any attempts at pointing a moral must be skilfully managed by questions, so that it may seem to come from the children themselves. The different virtues must be illustrated in rotation, and each time any one virtue recurs, a fresh story will show it in a new light, thus promoting variety of interest while preserving unity of purpose. At each new illustration of any one virtue the teacher should recall the former examples of it,

* 'Common School Education.' Currie.

† Bain's 'Education as a Science.' Page 449, head 5.

and trace the points of resemblance, by asking the children if they remember any other man who was as brave, or true, or whatever the virtue under consideration happens to be. This will call forth that 'flash of identity in diversity,' which is one of the greatest intellectual pleasures, and will heighten the interest and deepen the impression. The more unconscious the moral influence, the more telling it will be. '"The well-meant but futile," "hence we should learn," and "how important it is ever to remember," answer no purpose whatever in education, except that of giving the *congé* to the minds of the children, whether as auditors or readers; it is a "Now, you may go while I preach."'* However, though 'preaching' is so distasteful to them, the minds of young children are specially susceptible to unconscious moral influence. How often we read, in the biographies of great men, of the powerful impressions they had received in childhood from the accounts of heroes, whose deeds had given the first impetus to their own subsequent moral greatness; and who knows how much evil is imbibed in the earliest years from the imitation of base and unworthy examples? The feeling of hero-worship is stronger in early childhood than at any other time, and it seems a waste of moral influence not to take deliberate advantage of this in education, and so use the opportunity, which, if wasted then, will never occur again.

The very incapacity of the child for great intellectual effort, marks this out as the natural time for moral education, for, in the words of Abercrombie†: 'One of the most striking phenomena in the science of the human mind is the high degree of culture of which the moral powers are susceptible, even in the infant mind, long before the powers of intellect are developed for the investigation of truth.' The devouring appetite for stories which characterises most children, may be looked on as a guiding instinct in this direction, and as an instrument of attraction ready to furnish the essential element of enjoyment in the pupil, which Herbert Spencer looks on as the test of good teaching.

So much pleasure having been thus associated with the idea of history, the child is insensibly drawn on till he is ripe for beginning in earnest its systematic study; and this brings us to consider

THE ACQUIREMENT OF HISTORICAL KNOWLEDGE AND RESULTING MENTAL DISCIPLINE.

Here the vastness of our subject seems almost disheartening; we feel helpless in face of the immense amount of knowledge from which to choose. But as our powers are limited, and our life short, the great secret, as in all study, is a 'judicious limitation'—to set bounds to our ambition, and work within them; and here the last two divisions of our subject come in as useful auxiliaries, in helping us to select the most valuable portions of history to which to devote our attention.

It is neither possible nor desirable for us to acquire all the historical knowledge that is available; but it is necessary for us to know how to acquire and retain what is indispensable, and equally important for us to decide what is indispensable.

The history of the world resolves itself into very simple elements; it consists of the history of the different nations who have inhabited it. As many of these have left very little trace behind, history becomes circumscribed to an account of those nations which have left their mark on time, and still further narrowed to those which have had the greatest influence on mankind, first in ancient, and then in modern times. Having thus, as it were, analysed history till we have brought it down to the account of one nation at a time, we see that it is capable of still further decomposition, for the collective life of a nation is built up of the lives of individuals forming that nation. It is this individual element, forming, we may say, the ultimate atom in the composition of history, which is the simplest and easiest form in which we can present the study to the mind of a child. The two years' course which we have suggested, having sufficiently familiarised the children's minds with the individual element, the next step will be to present the atoms in their simplest form of combination in the early history of one people.

WHERE TO BEGIN.

The first history to be studied is naturally that of our own nation. In the first place, because it is the most concrete form in which we can present history; for, with the very scenes before our eyes, it is much easier to realise the events which have happened there. Secondly, it is much easier for a child to understand those of his own nation, and to sympathise with them than with foreigners; for each country has a strongly-marked national character, and it may be supposed that the inherited idiosyncrasies of his race are not without effect, even on a young child, in predisposing him to patriotic sympathies. In the third place, if history is to be studied with the view of acquiring a knowledge of human nature, it is better to begin with what is likely to throw light on the character of those among whom we live. As we know a man better if we are familiar with the peculiarities of his family character, from acquaintance with his father and grandfather, so an acquaintance with the past history of our race cannot fail to give us a clearer idea of those who are acting modern history around us. This applies with equal force to the political bearings of history, although they afterwards open out on the wider field of foreign politics, and show the necessity for studying the history of other countries, if we wish to acquire width of view and international sympathy. We shall further discuss these subjects under their respective heads, with the view of discovering which countries deserve most attention from their bearing on the points indicated.

In the meantime, supposing it granted that it is best to begin with the history of our own land, it has often been said that the somewhat vague and misty records, which are all that we have left to us of the earliest times, are exactly suitable to the opening powers of the child, whose conceptions on all subjects are at first indefinite and hazy, rather than clear and defined; and that this makes the childhood of the race a peculiarly appropriate study in the earliest years. But while we may agree to this so far, we must admit that there is much to be said on the other side; and it must not be forgotten that it may be difficult for a child to realise a state of things so different from what he sees around him as that which is characteristic of the remote past. However, we are justified in beginning with the earliest times by the fact that in the dawnings

* Isaac Taylor's 'Home Education,' page 258; quoted by Bain.

† Abercrombie's 'Intellectual Powers.'

of national life the historical element is confined to a few individuals, and clustered round the lives of kings and heroes, which present it in the concrete form most easily understood by children. As it becomes more complicated, the child is gradually carried along with it, and begins to understand by degrees the more intricate phases of the subject, till he no longer looks on it as the mere record of individual lives, but rises at length to the conception of history as 'the biography of a political society or commonwealth.'* An idea so abstract as that of a political society has no meaning to a child, and the simplest way to bring it home to him is to let him watch the actual evolution of government and political constitution as they are manifested in history. The first work to be undertaken, then, is the history of our own country. Most schemes of English history begin with the conquest of Britain by the Romans; but it seems more rational to give first a slight idea of the rude inhabitants to whom they brought the first beginnings of civilisation. Of course, the teacher would linger over them only long enough to let the children realise the primitive state of the country at that time. As a help to this he might exhibit prehistoric remains, such as flint arrow-heads, which are beautiful and interesting in themselves: such an object handed round a class would excite the keenest interest, and form a real tangible link of connection between the pupils and the ancient Britons—a simple beginning, but not to be despised. A class-visit to any Druidical stones in the district, if practicable, might also be interesting and useful. The actual sight of such relics would go a long way to impress the reality of history, when otherwise the vagueness of ancient records would leave no impression.

Any stories belonging to this period which the children may have heard should now be re-introduced, as a means of proceeding from the known to the unknown.

METHODS OF TEACHING.

In the most distinct method of teaching history which we have seen *(Manuel de Pédagogie et de Méthodologie)*, M. Braun also begins the study by a preparatory course of story-telling; but he confines the stories to the remarkable men or events of the child's native country. These biographies he gives in chronological order in the first course, and when the pupil gets to the second course each biography becomes the nucleus of the events which cluster round it, and the lives previously studied in an isolated aspect now form part of one connected whole, by means of the chain of history which unites them in chronological order.

There is a continuity of purpose and a clearness of arrangement in this which render it a most desirable method; and yet, if the moral elevation of the pupil be more important than his intellectual advancement, the scheme unfolded in our last section may still be thought worthy of attention. It might be possible to combine the two systems, by adhering to that of M. Braun towards the end of our two years' course.

FORMING THE FIRST IMPRESSION.

In the third session, the teacher begins to give history in a connected form to pupils who will now be eight or nine years of age. Selecting some lively and interesting history, he should read and explain portions of it while the children listen; for, though the pupils have now text-books, these are only to be used by them at home, when studying the lesson already given out and explained by the teacher. The principal part of the instruction will still be from the teacher himself, who, while careful to read and explain the text-book, will not by any means confine himself to it, but will use all his own resources to make a vivid impression of the facts under review. He will constantly vary the narrative with questions calculated to impress the meaning of what he is saying—those darting questions, in every direction, which do so much to keep up the liveliness of a class, and keep every pupil in that state of eager attention so favourable for receiving new impressions. These questions must have a distinct end in view, and should have been studied and arranged by the teacher beforehand (subject, of course, to the addition of any questions which may be rendered necessary by the answers he receives). This is what teachers technically call 'questioning-in' their subject.

We have already hinted that the children are not to refer to their books, even to follow the teacher when he is reading and explaining; the reason is, that they may give their entire and undivided attention—an indispensable condition in the imbibing of fresh knowledge. Besides, it should be borne in mind that, till the art of reading becomes 'secondarily automatic,' little use of the text-book should be made by the children in the class. Many teachers seem to forget that, even after a child can read with tolerable fluency, he cannot do so without an amount of conscious effort sufficient to withdraw his attention from anything else. It is difficult for us to realise this, after reading has become to ourselves an act as unconscious as breathing; but it should not be lost sight of.

Besides undivided attention, another condition is necessary for the reception of new impressions—that is, the perfect freshness of the physical powers. Bain insists strongly on this, as the formation of fresh nervous growths uses up more plastic material than any other mental work. It is for this reason that we propose to begin each day's lesson with the new work, so as to secure for that purpose the first fresh energies of the pupils, which are not so severely taxed by revisal.

In considering the means of strengthening first impressions of historical events, we feel inclined to give the most prominent place to the dramatic element, which, we believe, has not hitherto received much attention as an educational factor. Yet, if we analyse our own historical knowledge, it will generally be found that the periods of history which have left the most distinct traces in our minds are precisely those which lend themselves most naturally to dramatic treatment. The reign of Mary Queen of Scots—the death of Charles I., followed by the Protectorate—the period of the French Revolution—are instances of this: so vivid is the impression made on most people that no effort is needed to recall them.

The first necessity in dramatic treatment of a subject is a lifelike delineation of character; and, if the teacher has steadily bent his efforts, during the two years' course, to cultivating the historical imagination of his pupils, they will by this time be easily led to realise the characters presented to them, and to look on them, not as mere names out of a book, but as real human beings.

* Dr. Arnold's 'Lectures on Modern History.'

For this purpose, an effective use may occasionally be made of little gossipy details, which are of no value in themselves, but give a wonderfully lifelike touch to the characters they illustrate. We are aware that historical gossip is strongly tabooed as unsuitable by most educational writers, and we would agree with them so far as to draw a sharp prohibitory line at scandal; but we differ from them otherwise, as we think that it is impossible for children to realise a historical character, without some of the personal details which belong more to private than to public life.

If knowledge of human nature be admitted as one of the aims in teaching history, the study of individual character will naturally receive considerable attention. A skilful teacher will know how to elicit, by questioning, the pupils' impressions of the character under review, and how to suggest what is wanting in their efforts at realisation.

Having, then, presented the *dramatis personæ* in as lifelike a manner as possible, the next stage is to give an idea of their surroundings, physical and social. For the first, a knowledge of geography is indispensable, and the two studies, history and geography, act and re-act on each other with the happiest effect: a map should be constantly referred to in the course of a lesson on history. The social surroundings, also, should be illustrated by sketches of the manners and customs, and even dress and food, of the time, and by descriptions of the moral tone of society. Such accessories, well-managed (and not over-done), will illustrate the progress of civilisation in a manner within the reach of young children, and will help to pave the way for that 'descriptive sociology' which is too abstract at present for their immature minds, but which Herbert Spencer considers the only valuable form of history—an opinion with which we do not entirely agree.

The thread of narrative must now be taken up; and here the dramatic features which are to be found in all history must be seized upon, for the purpose of grouping events in those telling and effective combinations which are never forgotten.

This dramatic treatment would materially help teachers in their endeavours to merge their pupils' interest in the individuals into interest in their combined life as members of a society or of a nation. Care should be taken to leaven the collective action with enough of the personal element to keep up the interest. It is wonderful how sympathy can enable children to enter into feelings they could not otherwise understand: thus, if they can form a clear picture in their imaginations of some favourite hero, they enter by sympathy into his patriotic sentiments, or into his pity for the oppressed, and, through his efforts and struggles for freedom and better laws, they reach wider views of government and national life than they could ever attain to from a perusal of the calm sentences of the historian, which would never reach their inner consciousness at all.

The principal mental faculty exercised in receiving these first impressions is the imagination, and on it depend their clearness and depth. We have already alluded to its bearing on the other mental faculties, especially on that of memory, which comes into requisition in the next process we have to consider—the fixing of these impressions.

(To be continued.)

Chemistry of the Non-Metallics.

BY EDWARD AVELING, D.SC. LONDON.

[This series of articles, whilst dealing with the subjects required by the University of London for the Matriculation Examination and with those required at the Elementary Stage of the Inorganic Chemistry (Branch X.) Science and Art Department, is intended as a practical guide to the philosophical and systematic study of the non-metallics.]

CHAPTER VIII.

PROPERTIES OF OXYGEN. OZONE.

C. 1. A gas. One of the last to be liquefied. This has been effected by the methods of MM. Cailletet and Pictet.

2. Without taste or odour. Transparent, colourless.

3. 16 or $\frac{16}{14{\cdot}47}$.

4. Not very soluble in water. 100 cc. of water take up about 3 cc. of oxygen at 15°, and 4·1 cc. at 0°. The oxygen thus dissolved in water serves for the breathing of aquatic plants and animals.

5. Not combustible. The great supporter of combustion.

Combustion or burning may be defined as union with oxygen. This union of bodies with oxygen is not always attended with light or with flame. It is always attended with a rise of temperature. Combustion is a slow, quiet process in such cases as the decay of organised bodies, or the tarnishing of certain metals. It is a more rapid and more perceptible process in such cases as the respiration or breathing of living organised bodies, or the ordinary burning of substances. But all of these cases are unions of oxygen with other substances.

Flame is produced when a quantity of gas is, by union with oxygen, rendered luminous. But the light-giving power of a flame is much more intense when solid particles are present in larger numbers. They, heated, give out light. It is probable that no light is ever given out unless solid matter is present. On this the student should re-read the account of the oxygen-hydrogen blowpipe.

The following experiments should be performed in order to obtain clear ideas as to the action of oxygen as a supporter of combustion.

(*a*) Light a match. When it is burning thoroughly blow it out, leaving the end aglow. Plunge the red end into oxygen. The match is rekindled.

(*b*) Introduce a lighted candle into the gas (Fig. 23),

Fig. 23.

and compare its flame with that of a candle burning in the air outside. The candle in the oxygen burns the more brightly.

(*c*) Light, and by aid of the deflagrating spoon passed through a cork pass into jars of oxygen the following substances:—sulphur, sodium, phosphorus, wood-charcoal (this must be ignited by aid of a lamp), a piece of watch-spring. To light this last, its end, after cleaning

off any rust from it by means of a file, should be dipped in some sulphur, and the sulphur ignited before the watch-spring is placed in the oxygen. All of these substances burn, combining with oxygen to form different compounds.

The sulphur forms a gas called sulphur dioxide (SO^2), mixed with a little sulphur trioxide (SO_3). A piece of *moistened* blue litmus paper is reddened by this gas, denoting an acid reaction. Shake the gas up with water, and it is dissolved.

$$S + O^2 = SO^2$$
$$32 + 32 = 64$$
2 vols. 2 vols.

This gas, with water, forms a compound called hydrogen sulphite or common sulphurous acid.

$$SO^2 + H^2O = H^2SO^3$$
$$64 + 18 = 82$$

The sodium forms sodium oxide (Na^2O). A piece of *moistened* red litmus paper is turned blue by this gas, denoting an alkaline reaction. Shake the gas up with water and it is dissolved.

$$4Na + O^2 = 2Na^2O$$
$$92 + 32 = 124$$
2 vols.

This compound with water forms another compound called sodium hydrate (or sodium hydroxide), common caustic soda.

$$Na^2O + H^2O = 2NaHO$$
$$62 + 18 = 80$$

If the acid, hydrogen sulphite, and the alkaline, sodium hydrate, are brought together, they unite to form a neutral salt, sodium sulphite, while water is formed at the same time.

$$H^2SO^3 + 2NaHO = Na_2SO_3 + 2H_2O$$
$$82 + 80 = 126 + 36$$

The phosphorus forms dense white fumes of phosphorus pentoxide (P^2O^5). This compound is called pentoxide, because it contains 5 atoms of oxygen. This also shows an acid reaction to moistened litmus paper.

$$4P + 5O_2 = 2P^2O^5$$
$$124 + 160 = 284$$
10 vols. 4 vols.

The charcoal (carbon) forms a colourless gas, carbon dioxide (CO^2). Acid to moistened litmus paper.

$$C + O_2 = CO^2$$
$$12 + 32 = 44$$
2 vols. 2 vols.

The iron uniting with the oxygen forms the magnetic oxide (Fe^3O^4).

$$3Fe + 2O_2 = Fe_3O_4$$
$$168 + 64 = 232$$

A piece of *dry* iron placed in a jar of *dry* oxygen, and not ignited, forms no rust at all. The presence of water is necessary for the union of oxygen with iron.

If a stream of dry oxygen is passed over red-hot copper (not copper oxide) in an apparatus similar to that described and represented on page 495, vol. iv., the gas unites with the copper to form copper oxide. The copper should be weighed before the experiment, and the copper oxide after. For every 63 parts by weight of copper, there will be found to be 79 parts by weight of oxide.

$$2Cu + O_2 = 2CuO$$
$$126 + 32 = 158$$
2 vols.

One of the most interesting cases of combustion is that known as *respiration*. All living things breathe. When any part of a plant or animal works, it decays, *i.e.*, it burns. Every active tissue of a plant, every active organ of an animal when at work, burns. The parts of the working organ unite with oxygen that has been carried into the interior of the plant or animal. In the hjgher animals the blood is the fluid that conveys through the body the oxygen gas that has been taken into the lungs, or absorbed by the gills in the process of breathing.

In the bodies of higher animals, and therefore in man's, this union of oxygen with the active tissues does not take place in the lungs, but in the different organs of the body. The oxygen that has been breathed in is carried by the very fine blood-vessels or capillaries into every region, and passes through the thin walls of these minute vessels into the tissues supplied by them.

As two of the chief constituents of the animal and plant tissues are carbon and hydrogen, the combustion that accompanies the work results in the formation of carbon dioxide (CO^2) and steam (H_2O). The products of decay have to be eliminated. They are got rid of by the lungs, the skin, and kidneys. The lungs especially give out the carbon dioxide.

Respiration, therefore, is the elimination of the gaseous products of that combustion of the tissues which accompanies their work, and the taking in of the oxygen necessary for the combustion.

Plants *breathe* in exactly the same way as animals. But plants also *feed* on the air. The action of vegetables, therefore, on the atmosphere is two-fold. In their breathing they take in oxygen and give out carbon dioxide. But in their feeding a converse action takes place. The carbon dioxide is taken in by the green feeding parts of the plant, and is decomposed; the carbon is retained to help in forming the hard parts of the plant, and the oxygen is given out. Although the breathing process is a constant one and the feeding process only occurs in the sunlight, yet the latter is so much in excess of the former that the total effect on the air of vegetable things is the intaking of carbon dioxide and the outgiving of oxygen. The result of the respiratory action of animals and the effect of the twofold action of plants are therefore the converse one of the other.

To show the power that plants have of decomposing carbon dioxide an experiment narrated later may be performed. The experiment is given later on and not here, as its performance involves a knowledge of carbon dioxide.

6. *Specialties.*—Oxygen refracts light, *i.e.*, bends light out of a straight line, less than any other gas.

A good test for oxygen is the compound of caustic potash and an organic acid called pyrogallic acid. This acid takes its name from the fact that it is formed by heating gallic acid: πυρ (pur) = fire. To show this property, partly fill a tube with oxygen over mercury (not over water, as the latter contains oxygen in solution). Dissolve some pyrogallic acid and also some potash, and by aid of a little squirt cast up through the mercury into the gas, the acid solution first, and then the alkaline solution. The mixed solutions turn black, and the mercury rises, showing that the oxygen gas has been absorbed.

OZONE.—A special modification of oxygen requires consideration. It takes its name ozone from the Greek ὄζω (ozō) = I smell.

α. *Symbol.* O'.

β. *Weight number.* 24.

γ. *Preparation.* Send electric sparks through oxygen gas. Or rinse out a jar with warm water, leaving a little water in the jar; scrape *under water* a piece of phosphorus, and arrange it so that it is partly immersed in the water in the jar, and partly surrounded by air. Let it remain for an hour, and the oxygen of the air in the jar will have been transformed, partially at least, into ozone.

δ. *Properties.* i. A gas.

ii. As those of oxygen, except that ozone has a characteristic odour.

iii. 24 not 16 on the hydrogen scale, and $\frac{24}{14{\cdot}47}$ on the air-scale. Oxygen in becoming ozone contracts. 3 volumes ot oxygen become 2 of ozone.

iv. Less soluble than oxygen, 100 cc. of water dissolve only ·45 cc. of ozone.

v. A very active supporter of combustion. It is indeed oxygen in a very active condition.

vi. Ozone has a great tendency to get rid of 1 of the 3 atoms of oxygen that are condensed into every 2 atoms of ozone, and to return to the normal condition, the remaining 2 atoms becoming a molecule of the customary

oxygen. On this most of the special actions of ozone depend.

With Mercury.—Agitated with ozone, mercury unites with part of the ozone to form mercury oxide, and the rest of the ozone returns to the state of ordinary oxygen. There is, therefore, no change of volume.

$$\begin{array}{l} Hg + O'^{3}[O^{3}] = HgO + O^{3} \\ 200 + 48 \quad\quad = 216 + 32 \\ \quad 2 \text{ vols.} \quad\quad\quad 2 \text{ vols.} \end{array}$$

With Potassium Iodide and Starch.—Ozone decomposes the iodide, setting free the element iodine, and forming an oxide of the metal potassium. The free iodine joining with starch forms a deep violet-coloured compound. Papers prepared with potassium iodide and starch are, therefore, used as test-papers for ozone.

$$\begin{array}{l} 2KI + O'[O^{1}] = K_{2}O + I_{2} + O^{2} \\ 332 + 48 \quad\quad = 94 + 254 + 32 \\ \quad 2 \text{ vols.} \quad\quad\quad 2 \text{ vols.} \end{array}$$

On vegetable colours, such as indigo. These are bleached, as the compounds entering into them become oxidized.

If ozone is *passed through a heated glass-tube*, the temperature being not lower than 300°, it is re-converted into oxygen.

EXERCISES ON OXYGEN AND OZONE (*solved*).

72. What will be the volume of 112 grams of oxygen at normal temperature and pressure?

16 grams O occupy 11·2 litres.

1 gram „ occupies $\frac{11{\cdot}2}{16}$ „

112 grams „ occupy $\frac{11{\cdot}2 \times 112}{16}$ litres = 78·4 litres.

73. The weight of 5000 cc. of oxygen?

11·2 litres = 11200 cc. O weigh 16 grams.

1 „ „ weighs $\frac{16}{11200}$ grams.

5000 „ „ weigh $\frac{16 \times 5000}{11,200}$ „ = 7⅐ grams.

74. The volume of 144 hectograms oxygen at a temperature of 13°, and under pressure = 745 mm.?

16 grams O occupy 11·2 litres at 0° and 760 mm.

1 gram „ occupies $\frac{11{\cdot}2}{16}$ „ „ „ „

14400 grams „ occupy $\frac{11{\cdot}2 \times 14400}{16}$ „ „

273 vols. at 0° become 286 at 13°

1 vol. „ „ becomes $\frac{286}{273}$ „ „

$\frac{11{\cdot}2 \times 14400}{16}$ „ „ become $\frac{286 \times 11{\cdot}2 \times 14400}{273 \times 16}$ at 13°

Under pressure 760, vol. $= \frac{286 \times 11{\cdot}2 \times 14400}{273 \times 16}$

„ „ 1, vol. $= \frac{286 \times 11{\cdot}2 \times 14400 \times 760}{273 \times 16}$

„ „ 745, vol. $= \frac{286 \times 11{\cdot}2 \times 14400 \times 760}{273 \times 16 \times 745}$

$= 10,772\frac{23}{149}$ litres.

75. Weight of 7 litres oxygen at temperature of −26°, pressure 190 mm.?—We must first find out the volume at the normal temperature and pressure equivalent to 7 litres under the given conditions.

273 vols. at 0° become at −26° 247 vols.

1 vol. „ becomes „ $\frac{247}{273}$ „

7 vols. „ become „ $\frac{247 \times 7}{273}$ vols.

Under pressure 190 mm. the vol. is $\frac{247 \times 7}{273}$

„ „ 1 „ „ $\frac{247 \times 7 \times 190}{273}$

„ „ 760 „ „ $\frac{247 \times 7 \times 190}{273 \times 760}$

11·2 litres O at normal temperature and pressure weigh 16 grams.

1 „ „ „ „ weighs $\frac{16}{11{\cdot}2}$ „

$\frac{247 \times 7 \times 190}{273 \times 760}$ litres O at normal temperature and pressure weigh

$\frac{16 \times 247 \times 7 \times 190}{11{\cdot}2 \times 273 \times 760}$ grams. $= 2\frac{11}{12}$ grams.

76. 160 grams oxygen are converted into ozone. What vol. must they occupy?

16 grams. O occupy 11·2 litres.

1 gram „ occupies $\frac{11{\cdot}2}{16}$ „

160 grams „ occupy $\frac{11{\cdot}2 \times 160}{16}$ litres.

3 vols. O become 2 O′

1 vol. „ becomes ⅔ „

$\frac{11{\cdot}2 \times 160}{16}$ „ become $\frac{2 \times 11{\cdot}2 \times 160}{3 \times 16}$ O′ = 74⅔ litres.

QUESTIONS ON OXYGEN AND OZONE (*for solution*).

68. Find weight of the following: i. 700 cc. oxygen at normal; ii. $39\frac{1}{11}$ litres oxygen, temperature 39°, pressure 779 mm.; iii. 8⅔ litres ozone at normal temperature and pressure.

1 gram; 50 grams; 18 grams.

69. Find volume of the following: i. a mixture of 48 grams ozone with 48 grams oxygen; ii. 8 decagrams oxygen, temperature −273°, pressure 380 mm.; iii. 120 grams ozone, temperature 273°, pressure 1520 mm. ..... 56 litres; 56 litres; 56 litres.

(*To be continued.*)

—o—

Lessons in Latin.

BY THE REV. A. D. CAPEL, M.A., CANTAB.,

Formerly Examiner of Schools to Cambridge Local Examinations Syndicate.

(*Continued from page* 106.)

KEY TO EXERCISES.

EXERCISE 48.

A.

1. It greatly concerns the Christian commonwealth that (her) bishops should be learned and pious. 2. Cease to ask particularly of what in nothing (no way) concerns yourself. 3. It delights me to go over the deep. 4. It becomes you and your sisters. 5. I am wearied of these jokes. 6. I am vexed and ashamed of my brother. 7. Not to all men what is pleasing is allowed, nor does what becomes them delight all; more literally—It is not lawful to all men (to do that) which it is pleasing (to them to do), nor does it delight all men (to do that) which is becoming (for them to do). 8. He ('eum') who does not know the road by which he can go down to the sea, ought to search for a river as a companion. 9. If he had lived to his hundredth year, he would not repent of his old age. 10. I am ashamed and sorry for you.

B.

1. Non pudet me hoc fecisse. 2. Pœnitet me quod te offendisse. 3. Me non solum piget stultitiæ meæ, sed etiam pudet. 4. Eorum nos magis miseret, qui nostram misericordiam non requirunt, quam qui illam efflagitant. 5. Socratem non puduit fateri, se multas res nescire. 6. Nonne te hujus urbis, non vitæ, non lucis pudet. 7. Pudet deorum hominumque. 8. Multum mea interest, ut diligens sis (*or*, te esse

diligentem). 9. Cæsar dicere solebat, non tam suâ, quam reipublicæ interesse, ut salvus esset. 10. Miseret te aliorum, tui te nec miseret, nec pudet. 11. Eos partim scelerum, partim ineptiarum pœnitet. 12. Quem pœnitet peccavisse, pœne est innocens.

EXERCISE 49.

A.

1. The diseases of the mind are more destructive and more (in number) than (those) of the body. 2. I am more miserable than thou (*f.*), who art very miserable. 3. Every very learned (man) despises the Epicuræans. 4. Gorgias, the most celebrated sophist of the Greeks, being engaged at a great price, used to teach his arts. 5. A very good memory of former times is the mistress of human life. 6. Nothing is sweeter than the light of truth. 7. A certain peace is better and safer than a hoped-for victory. 8. With our five senses, but one mind, we comprehend the most unlike things, as colour, taste, smell, heat, and sound. 9. Apes, which have not tails, are very like the figure of a man. 10. In the highest mountains the air is drier and purer; when it is nearer the earth it is moister and heavier.

B.

1. Cicerone nemo Romanorum fuit eloquentior. 2. Nunquam nix minus quatuor pedes alta jacuit. 3. Puto mortem dedecore leviorem. 4. Rara avis in terris, nigroque simillima cygno. 5. Amor parentum dulcissimum industriæ præmium est. 6. Major est animi voluptas, quam corporis. 7. Roma et Neapolis maximæ sunt Italiæ urbes. 8. Nihil in amicitia perniciosius est quam adulatio. 9. Tempore hiberno dies sunt breviores et noctes longiores. 10. Veterrima vina non semper sunt suavissima. 11. C. Marius humillimo loco natus ad summos reipublicæ honores pervenit. 12. Inferior par abietis et terræ proxima enodis est; superior durior et nodosa.

EXERCISE 50.

A.

1. There is not any ring on his fingers. 2. Out of that battle about 130,000 men survived. 3. No one is able to pass (his) time happily, who only looks to himself. 4. The Consuls put up in public, engraved in brass, the laws of the Decemvirs, the name of which is 'the twelve tables,' (or which are called the 'twelve tables.') 5. Let those who would be at the head of the Republic keep this precept of Plato, viz., to so consider the advantage of (his fellow) citizens, that whatsoever things they do, forgetful of their own interest, they may render an account (of them) to it (the Republic). 6. Although we were not wanting in intellect (lit., intellect was not wanting to us), yet we certainly wanted learning. 7. He was not only engaged in these things, but was also at the head (of them). 8. A chimney-sweep, who had a large house, invited a fuller to remove to him. He answered, 'What partnership can there be between us, since you would befoul with soot and spots what I had restored (all) glittering?' This fable teaches that unlike things ought not to be joined together.

B.

1. Sunt mihi libri. 2. Mihi est nomen. 3. Vir mihi semper abest. 4. Sunt nobis mitia poma. 5. Nihil magis ægris prodest, quam ab eo curari a quo volunt. 6. Syracusis est fons, cui nomen Arethusa est. 7. Nemo adeo ferus est, ut non mitescere possit si modo culturæ patientem commodet aurem. 8. Vir bonus est, qui prodest quibus potest, nocet autem nemini. 9. Homini cum Deo similitudo est. 10. Mihi nec obest, nec prodest.

EXAMINATION QUESTIONS.

1. 'Suus' can only be used when referring to subject of principal sentence. 2. When the sentence joined by 'that' to its principal sentence answers the question 'what?' to the principal verb and its subject, it is a substantival clause, and must be translated by the infinitive mood, with an accusative case as its subject. At other times 'that' must be translated by 'ut,' or a word equivalent to 'ut.' 3. See answer to 2. 4. 'Hic' refers to the nearer—that is, latter—of the two; and 'ille' to the further—that is, former—of the two. 5. The intensive pronoun 'ipse,' 'he himself,' draws particular attention to the person referred to. A superlative of 'ipse' has been found in such an expression as 'ipsissima verba,' 'the very words.' 6. The participles wanting in Latin are the perfect active and the present passive. 7. A noun or pronoun coupled with a participle, independent of the sentence, is put into the ablative case, and said to govern itself; hence the term absolute. NOTE.—The sentence will always be found complete, if the absolute clause be omitted. 8. In English we sometimes use the nominative absolute. 9. 'He was born' is perfect, not imperfect. 'Was' is only a sign of the imperfect when followed by '-ing.' 10. A partitive genitive is used when the word signifying the whole is used for a part of it. 11. The infinitive mood is so called because it involves the general idea of the verb, irrespective of person and number, and is in reality a noun rather than a verb. 12. Impersonal verbs are verbs which have no subjects; 13, the real subject being the cognate noun involved in the verb.

LESSON LI.

ADVERBS AND THEIR COMPARISONS.

401. Adjectives are said to *qualify* their substantives, because they answer the question 'Of what sort?' (Lat., 'Qualis?') with regard to nouns, *e.g.*, 'Attentus discipulus.' What sort of pupil? Ans. An attentive one.

402. Adverbs, on the other hand, are said to *modify* the words with which they are connected, because they answer the question, in what manner (Lat., 'modus') anything is, or is done.

403. Since verbs can act in different ways, and adjectives can be applied to substantives in different degrees, and even adverbs themselves can be connected with the words they modify in more ways than one, adverbs are said to modify verbs, adjectives (including participles), and other adverbs.

404. The common adverbs of time, place, and quantity (interrogative, demonstrative, etc.), as 'nunc,' *now*, 'ubi?' *where?* have, to a great extent, been included in lessons that have preceded this one; but

those of place are here tabulated, and should be committed to memory.

Interrogative.	Relative.	Demonstrative.	Indefinite.	Universal.
Ubi, *where?*	ubi, *where* ubiubi, ubicunque.	ibi, *there* ibidem	alicubi, *somewhere*	ubique ubivis ubilibet } *everywhere*
Unde, *whence?*	unde, *whence*	inde, *thence*	alicunde, *from some place*	undique undevis undelibet } *from every-where.*
Quo, *whither?*	quo, *whither* quoquo, quocunque.	eo, *thither* eodem	aliquo, *to some place*	quovis quolibet } *to every place.*
Quâ, *in what direction?* *In what way?*	quâ, *in the way in which* quâquâ, quacunque.	eâ, *in that way* eâdem.	aliquâ, *in some way*	quâvis quâlibet } *in every way.*

It will be noticed that the relative is either the same as the interrogative, or the form doubled or increased by '-cunque,' of which the English is 'soever.'

405. Some adverbs of place, time, and quantity are followed by a genitive—as, 'Quo terrarum abiit,' 'Where in the world (lit., of the worlds) has he come from?'

406. 'En' and 'Ecce,' of which the English is 'Lo,' or 'Behold,' are sometimes followed by the nominative, and sometimes by the accusative—as, 'Ecce Homo!' 'Behold the Man!'

407. Adverbs derived from adjectives are followed by the same cases as the adjectives from which they are derived are followed.

408. Other adverbs than those of time and place are generally derived from adjectives—as, adj., attentus, Eng. *attentive;* adv., attente, Eng. *attentively.* But there are adverbs of this class which have no known corresponding adjective, as fĕrĕ, *almost;* and there are also adverbs derived from nouns and pronouns, besides some compounds of prepositions with pronouns and other adverbs.

409. O and A adjectives in -us, -a, -um (including all superlatives, but not all past participles), and -er, -ra, -rum, form their adverbs, by adding ē to the root—as, rectus, *right,* recte; æger, *sick,* ægre; miserrimus, *most miserable,* miserrime; liber, *free,* libere; but from 'conjunctus' and 'divisus,' past participles, we do not get 'conjuncte' and 'divise,' but 'conjunctim' and 'divisim.'

410. I adjectives form their adverbs by adding 'ter' on to the root, as, ferox, *fierce;* R. feroci; adv. ferociter.

411. Present participles, and other I adjectives whose roots end in *nti,* shorten the adverb, by syncopating the 'it' before the final 'er'—thus, amans, *loving;* R. amanti; adv. amanter, not amantiter.

412. A good many adverbs derived from substantives, as well as past participles, end in 'im'—as, vir, viritim.

413. Some adverbs end in 'itus'—as, antiquitus.

414. In addition to these, there are certain cases of certain nouns, etc., used as adverbs—*e.g.,* initio, *in the beginning;* modo, vulgo, magni (*great price*), etc.

415. The comparatives of adverbs, when derived from adjectives, are the neuter form of the comparative adjective, and the superlatives end in 'issime,' or 'errime,' as mentioned in paragraph 409.

416. Many expressions which were in constant use became written as one word, and used as adverbs—as, inter-ea, *in the meanwhile;* ad-huc, *up to the present time;* magnopere (magno opere—*with great labour*), *greatly;* forsitan (fors sit an, *it may be a chance whether*), *perhaps,* etc., etc.

417. Adverbs derived from pronouns end in 'c,' as, from iste, *that;* istic, *there;* etc.

418. Adverbs ending in 'nc,' imply 'from,' as hinc, *hence;* illinc, *thence.*

419. VOCABULARY 51.

Eng'ish.	*La'in.*		*English Deriv.*
Misery	miseria	G. miseriæ	
To seem	vidēri (dep.)		3rd R. vīs
Madness	amentia	G. amentiæ	
To go (forward)	progredi (dep.)		3rd R. progress
To violate	violare	P. R. violav	3rd R. violat
Right--privileges granted by the laws of men	-jus	G. juris	
Common	communis	R. commun	commune
Liberty	libertas	G. libertatis	
To concern / To belong	pertinēre	P. R. pertinu	
The day before	pridie (adv.)		
Literature	literæ (used in plur.)	G. literarum	
To study	studēre (foll. by dat.)	P. R. studu	student
Then	tunc (adv.)		
More / Further	amplius (comp. adv.)		ample
Suitably	convenienter (adv.)		
Pleasant	gratus -ta -tum	R. grat	grateful
Altar	altare (n. gen.)	G. altaris	
Root	radix	G. radicis	radical
Useless	inutilis	R. inutili	
Like	similis	R. simili	similar
Pallas	Pallas	G. Palladis	Palladium
Enough	abunde (adv.)		abundantly
Brave	fortis	R. forti	fortitude

420. EXERCISE 51.

A.

1. Eo miseriarum venturus (19) eram. 2. Nescire (48) videmini quo amentiæ progressi sitis. 3. Ubicunque terrarum (8) et gentium (38) violatum jus civium (8) Romanorum (20) est, ad communem libertatis causam (37) pertinet. 4. Pridie ejus (37) diei (8) venit (19) in senatum (19). 5. Sulpicius Gallus (a name) omnium (29) nobilium (38) maximè (49)

Græcis literis studuit. 6. Nihil (31) tunc temporis (17) amplius quam (48) flere (28) poteram (50). 7. Summum (49) bonum (49) dicitur (15) a Stoicis, convenienter naturæ (46) vivere (48). 8. Gratius ex ipso (40) fonte (12) bibuntur (14) aquæ (7). 9. En! quatuor (44) aras (18); ecce! duas (44) tibi, (35) Daphni, duoque (44) altaria Phœbo. 10. Qui (27) acutissime (49) et celerrime (49) rerum (13) causas (37) perspicit (27) is (37) jure prudentissimus (49) et sapientissimus (49) habetur (49).

B.

1. Write down the three degrees of comparison of adverbs derived from the following O and A adjectives:—Pulcher, planus, frigidus, rapidus, honestus, miser. 2. Write down the adverbs (positive degree) derived from the following I adjectives:—Velox, acer, duplex, elegans, decens, and celer. 3. Write down the adverbs derived from the past participle of the following verbs:—Rapio (39), sentio (39), stare (42), conjungere (50), curro (3rd R. curs), and separare. 4. Form adverbs in "itus" from cœlum (27), radix (a root), humanus (21), fundus (gen. fundi, a foundation), and divinus (33)—giving their English meaning. 5. The Mauri are very near (adv., 49) to Spain (19) (acc.). 6. He lives (48) uselessly to himself (35). 7. They build (17) a house (13) like a mountain (20) by the divine (33) art (49) of Pallas. 8. We have heard (4) fables (gen.) (44) enough. 9. The Gauls (10) fought (10) bravely. 10. The Carthaginians (43) had fought (10) very bravely.

LESSON LII.

IMPERATIVE MOOD.

421. The imperative, or commanding, mood is *now* divided into two tenses, present and future, which are thus given in modern grammars:—

ACTIVE VOICE.

Long A.	*Long E.*	*Present.* *Short E.*	*Long I.*	*Eng.*
		SINGULAR.		
2nd ama	mone	rege	audi	love, etc., thou
		PLURAL.		
2nd amate	monete	regite	audite	love, etc., ye
		Future.		
		SINGULAR.		
2nd amato	moneto	regito	audito	thou must love, etc.
3rd amato	moneto	regito	audito	he must love, etc.
		PLURAL.		
2nd amatote	monetote	regitote	auditote	ye must love, etc.
3rd amanto	monento	regunto	audiunto	they must love, etc.

The imperative mood of 'sum' is formed precisely in the same way, except that the 2nd pers. sing. of the present is 'es.'

422. The greater part of the pres. sub. used to be included in the imperative mood, and, no doubt, it is often used with an imperative meaning, especially in prohibitions.

423. 'Not,' with the imperative, is translated by 'ne, not 'non'; but in more polite language 'ne' is not found with the imperative, but with the pres. or perf. sub.

424. The four verbs, facere, dicere, ducere, and ferre (see Lesson 53), drop the 'e' in the 2nd pers. sing., and are 'fac,' 'dic,' 'duc,' and 'fer.'

425. It will be noticed that the 2nd and 3rd persons sing. of the future tense are formed from the 3rd sing. of the pres. ind. by adding 'o,' and that the 2nd pers. plur. in both tenses are formed from the 2nd pers. sing. by adding on 'te,' the short 'e' in regĕ becoming 'i.'

426. PASSIVE VOICE.

Long A.	*Long E.*	*Present Tense.* *Short E.*	*Long I.*	*Eng.*
		SINGULAR.		
2nd amare	monere	regere	audire	be thou loved, etc.
		PLURAL.		
2nd amamini	monemini	regimini	audimini	be ye loved, etc.
		Future Tense.		
		SINGULAR.		
2nd amator	mone'or	r gitor	auditor	thou must be loved, etc
3rd amator	monetor	regitor	auditor	he must be loved, etc.
		PLURAL.		
3rd amantor	monentor	reguntor	audiuntor	they must be loved, etc.

427. It will be noticed that the 2nd pers. sing. of the pres. tense is similar in form to the pres. inf. act., and that the 2nd pers. plur. is similar in form to the 2nd pers. plur of the pres. ind.

428. The future tense (except in the 2nd pers. plur., which is wanting) is formed from the future imp. act. by adding on 'r.'

429. VOCABULARY 52.

English.	*Latin.*		*English Deriv.*
To strew all over - *hence,* To overcome	consternare	R. constern	consternation
Door	fŏris, f gen.	G. foris	
To dash against	illidere	P. R. illīs	3rd R. illīs
To cry again and again	vociferare	R. voc'fer	voci'erate
To think	cogitare	R. cogit	cogitative
Some time	al quando (adv.)		
Account, Reason, etc., etc.	ratio	G. rationis	
Countenance	frons	G. frontis	front
Swift	velox	R. vel ci	velocity
To flourish	florēre	P. R. floru	No 3rd Root
To squeeze	prĕmo	P. R. press	3rd R. press
Slippery	lubricus -ca -cum	R. lubric	lubricate
Unwilling	invitus -ta -tum	R iav.t	
Enemy (personal)	inimicus	G. inimici	inimical
To celebrate	celebrare	R. celebr	celebration
Funeral rites	exequiæ, no sing.,	A declension	
Funeral	funus, n. gen.	G. funeris	
To permit	sinĕre	P. R. siv	3rd R. sit
To endure	tolerare	R. to'er	toleration
Before	prius-quam	sometimes separated by a word.	
To cross	trajicĕre (io)	P. R. trajec	3rd R. traject
Will	voluntas	G. volu tatis	voluntary
Iniquity	iniquitas	G. iniquitatis	iniquitous
To throw	jăcĕre (io)	P. R. jēc	3rd R. ject
A die	ălea	G. aleæ	
The mouth The face	os, n. gen.	G. ōris, often used in plur.	
Wheel	rota	G. rotæ	rotary
Needy Narrow	angustus -ta -tum	R. angust	anguish
Courageous	animosus -sa -sum	R. animos	
To take care	curare	R. cur	curate
To assist	adjuvāre	P. R. adjūv	3rd R. adjut
Vote	sententia	G. sententiæ	
To drive away	depellere	P. R. depŭl	3rd R. depuls
Terror	terror	G. terrōris	
To bring to	afferre	P. R. attŭl	3rd R. allāt
To scorn	spernĕre	P. R. sprēv	3rd R. sprēt
Uncertain	incertus -ta -tum	R. incert	
To wait for To expect	expectare	R. expect	expectation
To investigate	investigare	R. investig	
Wonderful	admirabilis	R. admirabili	
To find out	explorare	R. explor	
As often as	quotiens		
To attempt	conari, dep.		3rd R. conat
To prepare	parare	R. par	
As if	tamquam		
To speak	loqui, dep.		3rd R. locut
To doubt	dubitare	R. dubit	indubitable

430. EXERCISE 52.

A.

1. Augustus Variana (Eng., 'under Varus,' a Roman commander) clade (45) adeo (46) consternatus est ut caput (11) interdum (23) foribus

illideret vociferans, 'Quinctili Vare, redde (29) mihi (25) legiones (19) meas (20).' 2. Fac (43) (understand 'tu te ut') cogites aliquando vitæ (11) tuæ (20) rationem tibi (35) reddendam (29) esse. 3. Mentem (40) hominis (5) spectato (40) non frontem. 4. Velox dum (21) primi (47) floret tibi (35) temporis (17) ætas (44), utere (41). 5. Fortunam (40) pressis manibus (8) tene (18), lubrica est nec (48) invita teneri (18) potest (50). 6. Q. Metellus, post (17) mortem (8) Scipionis Africani, inimici sui (20), ad filios (7) conversus (41) dixit (15) 'Ite, (Eng., 'go') filii (7), celebrate exequias; nunquam (28) civis (8) majoris (49) funus videbitis (27).' 7. Dum (21) vires (42) annique (17) sinunt, tolerate labores (12). 8. Cæsar priusquam Rubiconem (Eng., 'Rubicon,' a river) trajecit, 'Eatur,' (Eng, 'we must go'; lit., 'let it be gone') inquit (Eng., 'says he'), quo (51) deorum (27) voluntas et inimicorum iniquitas vocat (11) jacta alea esto.' 9. Duc, inquam (Eng., 'I say'), invitas ipsa (40) per (Eng., 'over') ora rotas.

B.

1. In needy circumstances (things, 13), appear (16) courageous and brave (51). 2. Take care, (O) friend, (5) that you-are-strong (15), and assist us (35) with your (20) vote. 3. You (sing.) must drive away that (37) terror which (27) the novelty (46) of the circumstances (things, 13) has brought (sub. mood) to you. 4. Scorn pleasure (49); pleasure bought (28) with grief (39) hurts (50). 5. It is uncertain in what (27) place (9) death (8) waits for you (35): therefore (10) expect thou it (37) in every (all, 29) place (9). 6. You must investigate the cause (37) in a new (33) and wonderful thing (13), if (15) you are able (50) (fut. tense); if you find (41) (fut. tense) none (31), yet (20) you must hold (49) this (prop. case of 'ille') as found out, that nothing (37) is able (50) (perf. tense) to be (Lat., 'fieri') without (31) a cause (37). 7. As often as you attempt (fut. tense) anything (45), measure (45), yourself (35) as-well-as (Lat., 'et') those (prop. case of 'is') (things) which (27) you are preparing. 8. So (50) live (48) with (20) men (5) as if God (27) saw (27) (pres. sub.) you (35); so speak with (20) God as if men heard (pres. sub.) (4) you. 9. Do not do (43) what (27) you doubt (about).

LESSON LIII.

THE IRREGULAR VERBS, VOLO, NOLO, MALO, AND FERO.

431. The above verbs are very frequently used, and are irregular in the present tenses of all moods, and also in the imperfect subjunctive.

432. The present tenses are thus declined :—

INDICATIVE.

Sing.	volo	nolo	malo	fero
	vis	nonvis	mavis	fers
	vult	nonvult	mavult	fert
Plur.	volumus	nolumus	malumus	ferimus
	vultis	nonvultis	mavultis	fertis
	volunt	nolunt	malunt	ferunt

SUBJUNCTIVE.

Sing.	velim	nolim	malim	feram
	velis	nolis	malis	(regular)
	velit	nolit	malit	
	velimus	nolimus	malimus	
	velitis	nolitis	malitis	
	velint	nolint	malint	

IMPERATIVE.

	Present Tense.	
Sing. 2nd.	noli	fer
Plur. 2nd.	nolite	ferte
	Future Tense.	
Sing. 2nd.	nolito	ferto
3rd.	nolito	ferto
Plur. 2nd.	nolitote	fertote
3rd.	nolunto	ferunto

433. The present infinitives are 'velle' ('to be willing'), 'nolle' ('to be unwilling'), 'malle' ('to be rather'), and 'ferre' ('to carry'), from which, by adding on 'm' (as in all verbs), we immediately get the imperfect subjunctive, viz., 'vellem,' 'nollem,' 'mallem,' and 'ferrem,' which are declined quite regularly. Notice in 'velle,' etc., the one 'l' in the pres. sub., and the two in the imperf.

434. 'Nolo' and 'malo' are short for 'non-volo' and 'magis-volo,' of which the English is, 'I wish rather to be,' or 'I would rather be,' or 'prefer.'

435. The perfect roots are in the vocabulary.

436. It is probably a very loose way of talking to call 'tuli' and 'latum' the perfect and supine of 'ferre,' as, no doubt, the other roots of all three words were once used; the words, however, being synonymous, the forms that survived were put together and used, and considered, as parts of one word. (Compare Eng. 'went,' which certainly comes from 'wend,' though generally called the past tense of 'go.')

437. VOCABULARY 53.

English.	*Latin.*		*Eng. Deriv.*
Avarice	avārĭtia	G. avarĭtiæ	
To abolish	tollere	P. R. sustŭl	3rd R. sublāt
Luxury	luxuries	G. luxuriei	
Shame	pudor	G. pudoris	
Whether...or	utrum...an	(followed by sub. mood)	
To strip	exuere	P. R. exu	3rd R. exŭt
Example	exemplum	G. exempli	exemplary
To depart	recedĕre	P. R. recess	3rd R. recess
To destroy	extinguere	P. R. extinx	3rd R. extinct
Kindness	beneficium	G. beneficii	
Either...or	aut...aut		
To determine	destinare	R. destin	destination
To arrive	pervĕnire	P. R. pervēn	3rd R. pervent
To follow	sequi, dep.		3rd R. secut
Useful	utilis	G. utilis	utilitarian
To compel	impellere	P. R. impul	3rd R. impuls
Openly	palam		
Shout	clamor	G. clamoris	clamour
To arouse	concitare	R. concit	
To relate	referre	P. R. retŭl	3rd R. relāt
Wicked	nefandus -da -dum	R. nefand	
To endure / To bear	ferre	P. R. tŭl	3rd R. lāt
Eager	strenuus -a -um	R. strenu.	
To be willing	velle	P. R. volu	No 3rd R.
To be unwilling	nolle	P. R. nolu	No 3rd R.
To be rather	malle	P. R. malu	No 3rd R.
To be a slave to	servire	P. R. servi	3rd R. servit
Glory	gloria	G. gloriæ	
Riches	opes	G. opium (plu. of ops, power)	
To deny / To say...not / To refuse	negare	R. neg	negative

438. EXERCISE 53.

A.

1. Avaritiam si (15) tollere vultis, matrem (14) ejus (37) luxuriem tollere oportet (48). 2. Ne pudeat (48) quæ (27) nesciveris (48) te velle doceri (3). 3. Scire (14) aliquid (45) laus (22) est, pudor est nil (nihil) (31) discere (27) velle. 4. Multum (20) interest (48) utrum peccare (3) aliquis (45) nolit an nes-

ciat (48). 5. Si velis vitiis (46) exui, longe (38) tibi a vitiorum exemplis recedendum est. 6. Principem (43) se (35) esse mavult quam (48) videri (51). 7. Corinthum patres (14) vestri (33) extinctam esse voluerunt. 8. Cur (33) eum (37) defensum (42) esse vis? 9. Beneficiorum maxima (49) sunt ea (37), quæ (27) a parentibus (11) accipimus (28), dum (21) aut nescimus (48) aut nolumus. 10. Qui (27) quo (51) destinavit pervenire vult, unam (44) sequatur viam (48).

B.

1. It is useful for a boy (7) to have (7) (those) whom (27) he first (20) wishes (sub.) to imitate (45) afterwards (Lat., 'mox') to conquer (23). 2. We are compelled by nature (46) to wish (Lat., 'that we may wish') to do good (50) to as many (49) as possible. [Insert 'quam' before superlative.] 3. He is not willing to weep (28) openly. 4. Brutus, with a shout, arouses the Quirites (Lat., same word), and relates the wicked deeds (45) of the king (8). 5. I endured (use 'ferre') a wound (40) from (31) an enemy (10) (who was) not expected (fem.) 6. May the gods (27) bring (it) about (pres. sub. of 'facio') that you may not (for 'that not' use 'ne') wish to be eager. 7. He preferred to-be-a-slave to his (20) glory (rather) than (48) to (his) riches. 8. Not, O Mæcenas (same word) if (15) I were to wish for (imp. sub.) more (49), would you refuse to give (12). 9. He says (15) that he (35) would rather be a good (20) man (5) than (48) seem (51) (one). 10. If (15) you (plural) wish to fear (3) nothing (31), think (Lat., 'cogitate') that all (29) (things) must be feared (3).

(To be continued.)

—o—

Pupil Teachers' Examination Papers,

April 25th, 1885.

WITH ANSWERS.

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. What is the least weight which could be made up in parcels of 24, 32, 36, 45 lbs. each, and leaving 3 lbs. over in each case?

The least weight which could be made up in parcels of 24, 32, 36, and 45 lbs. each, is the L.C.M. of the quantities.

∴ No. required = L.C.M. of 24, 32, 36, and 45 + 3

4 | 24, 32, 36, 45
3 | 6, 8, 9, 45
2, 8, 15

4 × 3 × 8 × 15 + 3 = 1443. Ans.

2. What fraction of a ton is equal to $3\frac{1}{8}$ qrs. $- 6\frac{3}{4}$ lbs.?

$$\frac{3\frac{1}{8} \text{ qrs.} - 6\frac{3}{4} \text{ lbs.}}{1 \text{ ton}}$$

$$= \frac{\frac{25}{8} \times \frac{28}{1} - 6\frac{3}{4}}{2240}$$

$$= \frac{89\frac{7}{8} - 6\frac{3}{4}}{2240}$$

$$= \frac{83\frac{1}{8}}{2240}$$

$$= \frac{667}{8} \times \frac{1}{2240}$$

$$= \frac{667}{17920}. \text{ Ans.}$$

3. Find the exact value in money of ·0675£ + 3·45s. − ·2 florin; and express the result as the decimal of 9s. 4½d.

(·0675£ + 3·45s. − ·2fl.) ÷ 9s. 4½d.

20 | 12 | 24 | 12
1·3500 | 5·40 | 4·8 | 112½
12
4·2000

= 1s. $4\frac{2}{10}$d. + 3s. $5\frac{4}{10}$d. − $4\frac{8}{10}$d. ÷ 112½d.
= $52\frac{6}{10}$ ÷ $112\frac{5}{10}$
= 528 ÷ 1125
= ·469⅓. Ans.

4. A cask is ·72 full, but after 24 gallons are drawn off it is ·528 full; how many gallons would the cask hold when full?

Fraction full after 24 galls. are drawn off
= ·72 − ·528 = ·192
∴ ·192 = 24 galls.
And 1 = $\frac{24}{\cdot 192}$
= 125 galls. Ans.

FEMALES.

1. Find the cost of 29 acres 3 roods 5 poles at 100 guineas per acre.

	£	s.	d.		
2 r. = ½ a.	105	0	0	=	price of one acre
			29		
	3045	0	0	=	,, 29 acres
1 r. = ¼ of 2 r.	52	10	0	=	,, 2 roods
5 p. = ⅛ of 1 r.	25	5	0	=	,, 1 ,,
	3	5	7½	=	,, 5 poles
	£3127	0	7½	=	,, 29 a. 3 r. 5 p. Ans.

2. What must be given for 3768½ articles at £1 7s. 4½d. each?

	£	s.	d.		
5s. = ¼ £	3768	10	0	=	value at £1 each
2s. = $\frac{1}{10}$ £	942	2	6	=	,, 5s. ,,
4d. = ⅓ of 2s	376	17	0	=	,, 2s. ,,
½d. = ⅛ of 4d.	62	16	2	=	,, 4d. ,,
	7	17	0½	=	,, ½d. ,,
	£5158	2	8½	=	,, £1 7s. 4½d. Ans.

3. What is the least number of pounds of tea which you can divide into packets of 6, 18, or 22 lbs. each?

No. required = L.C.M. of 6, 18, 22.

3 | 6, 18, 22
2 | 2, 6, 22
3, 11

3 × 2 × 3 × 11 = 198 lbs. Ans.

4. Make out the following bill and receipt it:—

17 lbs. of candles at 4½d. per lb.
7¾ lbs. of tea at 2s. 3d. per lb.
27 lbs. of rice at 3½d. per lb.
11½ lbs. of currants at 2d. per lb.
¼ cwt. of soap at 3½d. per lb.

16, Anchor Street, Liverpool.
April 25th, 1885.

A. Brown, Esq.
Bought of William White.

	£	s.	d.
17 lbs. candles at 4½d. per lb.	0	6	8½
7¾ lbs. tea at 2s. 3d. ,, ...	0	17	5¼
27 lbs rice ,, 3½d. ,, ...	0	8	5¼
11½ lbs. currants at 2d ,, ...	0	1	11
¼ cwt. soap at 3½d. ,, ...	0	7	7
	£2	2	1¼

Received same time
£2 2s. 1¼d.
W. White.

Grammar.

MALES AND FEMALES.

'*Having reached* the house,
I found *its rescued* inmate *safely lodged*,
And in *serene* possession of *himself*
Beside a fire.'

Analyse these lines, and parse the words printed in italics.

Sentence.	Kind of Sentence.	Subject.	Predicate.	Object.	Extension.
Having reached the house, I found its rescued inmate safely lodged, and in serene possession of himself beside a fire.	P.S.	I having reached the house	found	its rescued inmate safely lodged, and in serene possession of himself	beside a fire (place)

Having—Pres. part. of trans. verb *to have*, referring to *I*, aux. to *reached*, indicating perfect tense.
reached—past part. of trans. verb *to reach*, ref. to *house*.
having reached—perf. part. from trans. verb *to reach*, qualifying *I*.
its—pers. pro., neut., sing., 3rd, poss., gov. by *inmate*.
rescued—partl. adj. of quality, qual. *inmate*.
inmate—com. noun, masc., sing., obj, gov. by *found*.
safely—adv. of manner, qual. *lodged*.
lodged—past part. of trans. verb *to lodge*, qual. *inmate*.
serene—adj. of quality, qual. *possession*.
himself—a com. per. pro., masc., sing., 3rd, obj., gov. by *of*.
beside—a prep., showing rel. between *fire* and *found*.

2. What are the different meanings of the English termination 'en' when added to a noun, an adjective, and a verb? Give instances.

When added to a noun it forms *plural no.* or *fem. gender*, or *diminutives*, as: ox, oxen; fox, vixen; maid, maiden; cat, kitten.
When added to an adjective it denotes material, as: wood, wooden; gold, golden.
When added to a verb it denotes *to make*, as: weak, weaken; sweet, sweeten.

3. How would you parse fully a noun? Explain each term you use.

I should give the class to which it belonged, its gender, number, person, and case, showing its relation to other words in the sentence.
The *classes* of nouns are the separate kinds of nouns—as proper, common, abstract.
The *gender* of nouns is the distinction of sex, whether masculine, or feminine, or common to both, or of neither gender.
The *number* determines whether the word stands for one or more than one: the singular being one, the plural more than one.
The *case* is the form of the noun which shows its relationship to the other words in the sentence, and is either nominative, possessive, or objective.

Geography.

Answer two questions, and draw one map.

1. Draw a map of one of the following:—
(*a*) Scotland, north of the Forth and Clyde.
(*b*) The basin of the St. Lawrence.
(*c*) Queensland, New South Wales, and Victoria.

2. Name and describe the *leading* industries of the United Kingdom, and assign reasons why each should be placed in its particular seat.

The principal industries of England are its manufactures of cotton, woollen, iron and steel, silk, and earthenware.
Cotton is the most important manufacture, and is carried on almost entirely on the Lancashire and Cheshire coal-field. These towns are near the port at which cotton is landed, the chief supply being from America.
Woollen is the oldest English manufacture.
The counties round about the places of manufacture formerly produced the greatest quantity of the raw material.
Iron and steel are manufactured chiefly on the spot whence the ore is obtained, coal being almost invariably found where iron abounds. Carriage of raw material and fuel is thus saved.
Silk is manufactured in London and Coventry, in the place where the first silk weavers, who were foreigners, settled.
Earthenware is manufactured in North Staffordshire, the clay of the district being suitable for the purpose.
In all the manufactures the raw material is obtained, steam-power is almost exclusively used, and the manufacture carried on in large buildings provided for the express purpose; erected where the facilities for obtaining the raw material and the necessary water and fuel are greatest. The value of the industries is in the order given.

3. What imports do we receive from
(*a*) Canada.
(*b*) Newfoundland.
(*c*) Australia.
What exports do we send to each of the above colonies, and with which of their seaports do most of our vessels trade?

From Canada we receive timber (sawn and unsawn), ashes (pot and pearl), wheat, flour, meat (preserved and fresh), skins and furs. In return, we send them every kind of manufactured goods (cotton, linen, woollen and silk), hardware of all kinds, and the various kinds of English, European, and Colonial produce to Montreal, Quebec, Three Rivers.
From Newfoundland we receive the produce of the fisheries—dried fish, seal, cod, and train oils, sealskins, salmon, cod, herrings, and other fish. To St. John's, the only port of importance, we send iron goods of all kinds, cotton and woollen goods, earthenware, salt, wines, and brandies, and other articles imported into England.
From Australia we get gold, wool, tallow, hides, copper, wheat, flour, meat. We send to Sydney, Melbourne (Williamstown), Brisbane, Geelong, Adelaide (Port Adelaide), and Perth (Freemantle), manufactured goods (cotton, woollen, silk), hardware, and all iron goods, boots and shoes, books.

4. Account for the various formations of
(*a*) Rivers.
(*b*) Mountains.
And give examples to illustrate your answers.

The water that falls on the surface of the earth partly sinks into the ground, and partly flows from the surface to lower levels in streams and rivulets. These streams and rivulets unite as they descend from the higher land and reach the valleys and plains, and form rivers. This is the usual way in which rivers are formed. Sometimes, however, water wells up from the ground after it has sunk to an impervious bed, and finding its way to the surface, becomes the source of a river. The melting of snow and glaciers is also one reason for the formation of rivers, while mountain lakes, the production of many small streams, also serve as the sources of others. The English rivers, Thames, Severn, etc., are the drainage of the land; the Danube rises in a spring; the Rhine and the Rhone rise in glaciers; and the Nile rises in the upland lakes of Africa.
Mountains are in ranges, groups, systems, or isolated peaks. Sometimes the ranges consist of a single ridge, as the Pennines, sometimes the range is broad, and consists of a series of ridges many miles across, as the Alps. Several ranges more or less connected, or a number of peaks, form a group; while groups and ranges which belong to the same formation form a system, as the southern system of Europe. Isolated peaks are common in volcanic districts, as Etna. The mountain ranges are the result of volcanic and earthquake action operating through a long series of ages, and consist of numerous upheavals. The wider the range and the more rugged the character of the mountains, the longer and the more violent have been the agents employed. Isolated peaks and less prominent hills with rounded tops are upheavals of more recent times, and of less pronounced violence. The various appearances of the hill-tops are the results of the action of wind and rain and climate generally, through a long series of years.

History.

1. When did the Romans abandon Britain? What induced them to do so?

The Romans finally abandoned Britain in 420 A.D. For many years the Roman Empire had been torn by dissensions. It was divided into the East and West Empires at the death of Theodosius in 385, and as the Emperor of the West was but a youth the enemies of Rome attacked it in every quarter. Africa was lost, Dacia, Thrace, and other provinces were laid desolate, and Alaric the Goth ravaged Italy. Roman troops were recalled in 403, and although Constantine regained lost ground for a time, at his death, and during the reign of Honorius, about 420, the Romans finally abandoned the island, and went to Italy to assist in driving back Attila the Hun.

2. Of the Saxon States three became dominant; tell which they were and describe their territory.

The three Saxon States which gradually absorbed the others were Northumbria, Mercia, and Wessex. Northumbria embraced all the land north of the Humber and Mersey; Mercia, between the Humber and Thames, and westwards from the North Sea to Offa's Dyke between the Dee and the Severn, and Wessex, the country south of the Thames, with the exception of Devon and Cornwall.

3. How came there to be Danish kings in England? Name them with their dates.

The Danes made many incursions into England, and different means were adopted to get rid of them. Among others, Ethelred the Unready bribed them, and levied Danegelt for the purpose of raising the money. When he found this did not serve, he determined on a general massacre of the Danes. This was carried out; Sweyn's sister was killed, and he came to revenge the death of her and her countrymen. The result was Edward was driven from the throne, and Sweyn reigned in his stead. The Danish kings were:

Sweyn	...	...	...	1013—1014
Canute	...	...	...	1014—1036
Harold	...	...	...	1036—1039
Hard'canute	...	...	...	1039—1041

Composition.

Write from memory the substance of the passage read to you by the Inspector.

At the Court of Francis the First, King of France, a fight of lions was one day exhibited. A lady of the Court threw her glove among the lions, and called upon her lover, one of the bravest and most gallant captains of France, to recover it for her. He wrapt his cloak round his left arm, sprang into the arena, and with drawn sword advanced boldly upon the lions. They were awed by his intrepidity a d did not touch him; so he picked up the glove, and returned safely to the place where he had been sitting with his lady. But when he came there, he threw the glove in her face, and said that he renounced the love of one who out of vanity could expose her lover to such useless peril.

Needlework.

FEMALES.

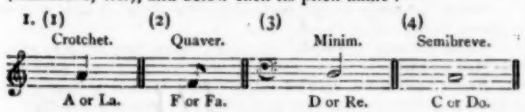
One hour will be allowed for this exercise *in the afternoon.*

Music.

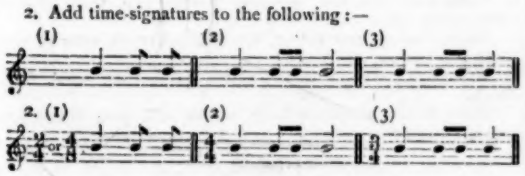
A quarter of an hour allowed for this paper.

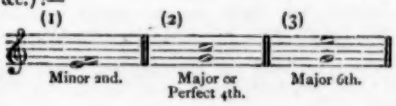
(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write above each of the following notes its value-name (semibreve, &c.), and below each its pitch-name:—



2. Add time-signatures to the following:—



3. Write below each of the following intervals its name (major fourth, &c.):—

TONIC SOL-FA NOTATION.

1. Write (1) a six-pulse tone using two-pulse measure; and (2) a six-pulse tone using three-pulse measure.

1. (1) | 1 :— | — :— | — :— ‖

(2) | 1 :— :— | — :— :— ‖

2. Write the names of the following intervals:—(1) *me* to *fah*; (2) *soh* to *te*; (3) *fah* to *me*'.

2. (1) Minor second; (2) major third; (3) major seventh.

3. Write the following an octave higher, and state what is meant by the direction "Key G":—

Key G.

	| d	:s	| m	:f	| s	:l	| r	:s	| m	:— ‖
3.	| d'	:s'	| m'	:f'	| s'	:l'	| r'	:s'	| m'	:— ‖	

"Key G" means that *doh* is to be fixed to the particular sound called G.

SECOND YEAR.

Pupil Teachers at end of Second Year.

FIRST PAPER.

Three hours and a half allowed.

Euclid.

MALES.

All generally understood abbreviations for *words* may be used, but not symbols of operation, such as −, +, ×.

(*Answer two questions, including question 3, if you can.*)

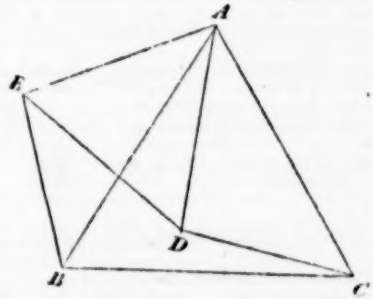
1. If two triangles have two sides of the one equal to two sides of the other, each to each, and have likewise their bases equal; the angle which is contained by the two sides of the one shall be equal to the angle contained by the two sides equal to them, of the other.

Euclid, Book I., Prop. 8.

2. Any two sides of a triangle are together greater than the third side.

Euclid, Book I., Prop. 20.

3. Any point D is taken within an equilateral triangle ABC, and on AD, on the same side of it as B, an equilateral triangle ADE is described. Prove that BE is equal to CD.



Let ABC be an equilateral △, and AD be drawn to a point D within the △. On AD describe the equilateral △ ADE. Join BE, CD. Then BE=CD.

The ∠ EAD = ∠ CAB, and the part BAD is common to both.

∴ rem. EAB = rem. CAD.

∵ in two △'s EAB, CAD, EA=AD, and AB=AC.

∴ two sides, EA, AB = two sides AD, AC, each to each, and ∠ EAD = ∠ CAD.

∴ (I. 4) base EB = base CD. Q. E. D.

Arithmetic.

FEMALES.

1. Simplify $\left\{2\frac{3}{4}+2\frac{1}{2}\text{ of }\frac{7}{3\frac{1}{2}}-\frac{1\frac{3}{4}}{2\frac{1}{2}}\right\}\div 1\frac{77}{176}$.

$$\left\{2\tfrac{3}{4}+2\tfrac{1}{2}\text{ of }\frac{7}{3\frac{1}{2}}-\frac{1\frac{3}{4}}{2\frac{1}{2}}\right\}\div 1\tfrac{77}{176}$$

$$=\left\{\tfrac{11}{4}+\tfrac{1}{2}\times\tfrac{14}{7}-\tfrac{7}{4}\right\}\div\tfrac{253}{176}$$

$$=\frac{627+1050-152}{228}\times\tfrac{176}{253}$$

$$=\tfrac{1525}{228}\times\tfrac{176}{253}$$

$$=5.\ \text{Ans.}$$

2. I lost $\frac{1}{5}$ of my property in an unfortunate speculation, and then had £1562 3s. 4d. left. How much did I lose? And how much had I at first?

If $\frac{1}{5}$ were lost $\frac{4}{5}$ were saved
$\frac{4}{5}$ = £1562 3s. 4d.
$\therefore \frac{1}{5}$ = £781 1s 8d. lost. Ans.
And $\frac{5}{5}$ = £2343 5s. at first. Ans.

3. Find the value of $\frac{3}{14}$ of £1 + $\frac{1}{2}$ of 2s. 6d. + $\frac{2}{7}$ of a guinea, and express the result as the fraction of a guinea.

$$\frac{£\frac{3}{14} + \frac{1}{2} \text{ of } 2s.\ 6d. + \frac{2}{7} \text{ of } 21s.}{21s.}$$
$$= \frac{\frac{3}{14} \times \frac{240}{1} + \frac{1}{2} \times \frac{30}{1} + \frac{2}{7} \times \frac{252}{1}}{252}$$
$$= \frac{30 + 24 + 108}{252}$$
$$= \frac{162}{252}$$
$$= \frac{9}{14}. \text{ Ans.}$$

4. Convert the following fractions into decimals:—$\frac{1\frac{3}{4}}{2\frac{1}{2}}$ and $\frac{23}{160}$

$\frac{1\frac{3}{4}}{2\frac{1}{2}} = \frac{\frac{7}{4}}{\frac{5}{2}} = \frac{7}{10} = .75$. Ans.
$\frac{23}{160} = .14375$. Ans.

Grammar.

MALES AND FEMALES.

1. '*Hadst* thou *but lived*, *though* stripped of power,
A *watchman* on the *lonely* tower,
Thy thrilling trump had roused the land,
When fraud *or* danger *were* at hand.

Paraphrase this passage, analyse it, and parse the words printed in italics.

If thy life had been prolonged, thou wouldst, although thou hadst no longer held the reins of government, have acted like a sentinel, and with thy clarion voice, and by thy clearness of utterance, have stirred up thy countrymen to meet the approach of danger of every kind.

ANALYSIS.

Sentence.	Kind of Sent.	Connective.	Subject.	Predicate.	Object.	Extension.
(*a*)						
Hadst thou but lived	Adv. Sent. cond. to *c*	[If]	Thou	hadst lived		but
(*b*)						
though stripped of power	Adv. Sent. cond. to *c*	though	thou [und.]	[had t been] stripped	of power [ind.]	
(*c*)						
Thy thrilling trump had roused the land	Prin. Sent.		thy thrilling trump	had roused	the land	
(*d*)						
A watchman on the lonely tower	Adv. manner to *c*	[as]	A watchman on the lonely tower	[rouses]	[the land]	
(*e*)						
When fraud	Adv. time to *c*	when	fraud	were at hand		
(*f*)						
or danger were at hand	Adv. time to *c*	or	danger	were at hand		

Hadst—aux. to *lived*, ind. subj. mood, pluperfect tense.
but—adv. of manner, qual. *hadst lived*.
lived—past part. of *to live*, ref. to *thou*.
hadst lived—reg. int. verb, act., subj., pluperfect, 3rd, sing., agreeing with *thou*.
though—disj. conj., joining the two sents., 'Hadst thou but lived' and 'Thou hadst been stripped of power.'
watchman—com. noun, masc., sing., nom. to *rouses*. (For construction see analysis.)
lonely—adj. of quality, qual. *tower*.
thy—pers. pro., masc, sing., 3rd, poss., gov. by *trump*.
thrilling—adj. of quality, qual. *trump*.
trump—com. noun, neut., sing., 3rd, nom. to *had roused*.
when—advb. conj., cop., joining the two sents, 'Thy trump had roused' and 'Danger were.'
or—Disj. conj., joining the two sentences, 'Danger were' and 'Fraud were.'
were—irr. int. verb, act., subj, past, 3rd, sing., agreeing with *fraud*.

2. Give the meaning of the following Latin prefixes, and illustrate each by two English words: 'ad,' 'ante,' 'contra,' 'extra,' 'retro,' 'sub,' 'ultra':—

a'—to, as, admit, adhere.
ante—before, as, antedate, anteroom.
contra—against, as, contradict, contravene.
extra—beyond, as, extraordinary, extramural.
retro—backwards, as, retrograde, retrospect.
sub—under, as, submit, subtract.
ultra—beyond, as, ultra-marine, ultra-montane.

3. State, with examples, some of the Latin terminations in English abstract nouns.

-ion, as, opinion, dominion.
-tion, -sion, as, motion, ascension.
-ment, as, movement.
-ty, -ity, as, poverty, dignity.
-tude, as, similitude, gratitude.
-our, as, ardour, error.
-cy, as, clemency, supremacy, magistracy.
-ure, -ture, -sure, as culture, verdure, erasure.
-ance, -ence, as, abundance, pretence.
-mony, as, patrimony, matrimony.

Geography.

(Answer *two* questions, and draw *one* map.)

1. Draw a map of one of the following:—
(*a*) The Baltic Sea.
(*b*) The basin of the Danube.
(*c*) Italy.

2. What are our chief imports from—
(*a*) The countries touching the Baltic Sea.
(*b*) The countries touching the Mediterranean.

Arrange them as nearly as you can in the order of importance.

From Germany we get agricultural produce, wool, timber, wines, manufactured goods, mineral waters, pitch, linseed.

From Russia, grain, timber, hides, skins, flax, hemp, tallow, wool, linseed, and hempseed.

From Denmark we get agricultural produce, as horses, cows, sheep, butter, eggs, bacon.

From Norway and Sweden, timber, iron, fish, copper, cattle, butter, pitch.

From France we receive silks, wines, brandies, lace, gloves, haberdashery, clocks, jewellery, and fancy goods generally.

From Italy, raw silk, sulphur, marble, rice, fruit, olive-oil, straw-plait, cork.

From Turkey, raw cotton, raw silk, olive oil, attar of roses, morocco leather, and fruits.

From Spain we get wines, silver, quicksilver, wool, fruits, cork.

From Greece we obtain fruits, cotton, silk, gum, honey, bees-wax, sponge.

3. What articles do we import from, and export to British India? Describe the cultivation and preparation of *three* of the principal vegetable productions of the country.

The imports from India are raw cotton, wool, hemp, jute, hides, silk, indigo, teak, and saltpetre, rice, tea, sugar, coffee, spices, and oils.

Our exports to India are manufactured goods of all kinds, railway plant, ale, beer, books, and furniture for the English residents.

Cotton requires a sandy soil. The seed is sown early in the year in rows five or six feet apart, in holes eighteen inches apart. When young the plants are thinned and topped to prevent upward growth. Great care is bestowed till the time of flowering. When the pods burst the cotton is gathered into bags, and then cleared from seeds and husks by the gin. It is packed in bales for export.

Rice is one of the staple products of India. It is grown in

moist soils, or such as are constantly irrigated. When cut down the grain is removed from the husks by means of the millstone, or in some districts by the tread of the oxen, and packed in bags for export. The rice plant is grown either from seed or from cuttings.

Indigo grows rapidly from seed, and when cut down it is carried to the factory, where it is steeped in water, and pressed for twelve hours. The water is then allowed to escape, and is of a yellow colour. As it cools it absorbs oxygen, turns blue, and granulates. The grains are exposed to heat, pressed, dried, and cut into small cubes for export.

4. What do you understand by latitude and longitude? Show how degrees of longitude vary in length. Whereabouts is a ship whose latitude is 51½° N., and whose longitude is 1° E.?

Latitude is distance north or south of the Equator. Longitude is distance east or west of a given meridian, which passes through the Poles. Every circle is divided into 360°, and as the circumference of the earth at the Equator is nearly 25,000 miles, it follows that each degree will be the 360th part of that diameter, or 69,⅙ miles. The circles (parallels of latitude) parallel with the Equator decrease in size till they come to a point at the Poles. The less the circle, therefore, the less will be a degree, and so degrees of longitude vary in length as they approach or recede from the Equator.

In the mouth of the Thames, a short distance from Shoeburyness and Sheerness.

SECOND PAPER.

Two hours and a half allowed.

Needlework.

FEMALES.

The needlework specimens will be collected by the Inspector at the expiration of one hour after the distribution of the examination paper.

Arithmetic.

MALES.

1. In how many years will £1501 5s. amount to £1763 19s. 4½d. at 3½ per cent. per annum?

Total int. to be gained = £1763 19s. 4½d − £1501 5s.
= £262 14s. 4½d.

£ s. £
∴ 1501 5 : 100 :: 1 yr. : 5 yrs. Ans.
3½ : £262 14s. 4½d.

2. A man by selling flour at 33s. 9d. a sack gains 12½ per cent.; what did the flour cost him per sack?

33s. 9d. represents selling price + gain
= 100 + 12½ = 112½
∴ 112½ = 33s. 9d.
$1 = \frac{33\text{s. } 9\text{d.}}{112\frac{1}{2}}$
$100 = \frac{33\text{s. } 9\text{d.} \times 100}{112\frac{1}{2}}$
= 30s. Ans.

3. A man has £3000 stock in the Three per Cents, and he sells out at 101, and invests the proceeds in 4 per cent. debentures at 125. Find the gain in his income. (Omit brokerage.)

£3000 in 3 per cents. will produce an income of
$\frac{3000 \times 3}{100} = £90$ First income.

Proceeds of sale $= \frac{3000 \times 101}{100} = £3030.$

£3030 invested in 4 p.c. at 125 will produce
$\frac{3030 \times 4}{125} = £96$ 19s. 2⅖d. Sec. income.

Diff. = £96 19s. 2⅖d. − £90 = £6 19s. 2⅖d. gain. Ans.

4. A hare starts 55 yards before a hound; if the hare take 7 leaps of 5 feet each in 3 seconds, and the hound 9 leaps of 7 feet 6 inches each in 5 seconds, in what time will the hound catch the hare?

The hare leaps $\frac{7 \times 5}{3} = \frac{35}{3} = 11\frac{2}{3}$ feet per sec.

The hound leaps $\frac{7\frac{1}{2} \times 9}{5} = \frac{67\frac{1}{2}}{5} = 12\frac{1}{2}$ " "

∴ hound gains per sec. 12½ − 11⅔ = ⅚ feet.

55 yards = 165 feet
Time to gain ⅚ feet = 1 sec.
" " 1 foot $= \frac{1}{\frac{5}{6}}$
" " 165 feet $= \frac{1 \times 165}{\frac{5}{6}}$
= 90 secs. Ans.

History.

MALES AND FEMALES.

1. William II. and Henry II. had disputes with two great ecclesiastics; give the names of both of them, and sketch the character and career of one.

Anselm, Archbishop of Canterbury, suffered at the hands of William II., and Thomas à Becket seriously quarrelled with and was murdered at the instance of Henry II.

Thomas à Becket, when quite young, became Archdeacon of Canterbury, and soon afterwards a great favourite with the king, who made him his chancellor. On the death of Theobald, much against his wish, Becket was made Archbishop of Canterbury, and his style of life was immediately changed. He now lived frugally and austerely, and fought strenuously for the rights of the clergy, whom he had before opposed.

The chief contention of Henry respecting them was that they should be tried by the courts of law. The Council of Clarendon decided in favour of Henry. Becket yielded for a time, but afterwards resumed the struggle, and, to escape death, fled to France. He became reconciled in six years, but when he returned he found the lands of the see confiscated, and excommunicated all who would not give them up. Henry used strong language, and some knights killed Becket at Canterbury. Henry afterwards did penance.

2. When was there a prospect that England would have kings named Alphonso and Eustace? Give the names and dates of the princes who actually came to the throne.

Alphonso was the eldest son of Edward I., but died before his father. The crown fell to Edward II., the second son of Edward I., who began to reign 1307 A.D., and died 1327 A.D.

Eustace was the son of Stephen. After the conclusion of peace with Henry, Eustace was very much annoyed, and went to the west of England to raise a rebellion. It is said that he ravaged the country, and died of a frenzy when sitting down to a banquet.

Henry II., the son of Matilda, and grandson of Henry I., ascended the throne on the death of Stephen, A.D. 1154, and reigned till 1189 A.D.

3. When did the reduction of Wales take place? Why do you suppose that was the last part of South Britain to be united to the rest?

Wales was finally conquered by Edward I. in 1282.

The Welsh were the descendants of the ancient Britons. They retained all the hardihood and bravery of their forefathers; they loved their country and freedom, and the spirit of their ancestors and their desire for a national existence enabled them to defy in their fastnesses among the mountains all attempts to subdue them till the time of Henry II.

Teaching.

What use would you make of the blackboard in teaching writing to a young class?

The blackboard would be used for teaching the size, shape, and formation of letters; for copies for imitation; and for correcting the faults observed in the writing of the class. When the copy consisted of words, it would be used to show clearly the method of joining the letters together at regular distances, to correct mistakes in making the curves and the heights of the letters. If the blackboard had not lines already ruled for some of the exercises, it would be temporarily ruled with chalk.

Music.

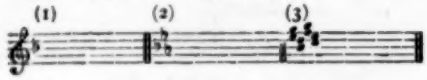
OLD NOTATION.

A quarter of an hour allowed for this paper.

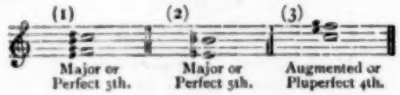
(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write the key-signatures of each of the following major keys:—(1) of F; (2) of E♭; (3) of E.

1. (1) (2) (3)



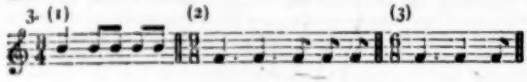
2. Write below each of the following intervals its name (major second, &c.):—

2. (1) (2) (3)

Major or Perfect 5th. Major or Perfect 5th. Augmented or Pluperfect 4th.

3. Add time-signatures to each of the following:—

(1) (2) (3)

3. (1) (2) (3)



TONIC SOL-FA NOTATION.

1. Write the names of the following intervals:—(1) *lah* to *me*; (2) *doh*[1] to *fah*; (3) *te* to *fah*; (4) *fah* to *te*,.

1. (1) Major or perfect fourth; (2) major or perfect fifth; (3) pluperfect fourth; (4) minor fifth.

2. What is the mental effect of (1) *fah*; (2) *me*; (3) *lah*?

2. (1) Serious, grave, expectant; (2) calm, peaceful, tranquil; (3) sad.

3. What are the five kinds of measure most commonly used?

3. Two, three, four, six, and nine-pulse measures.

THIRD YEAR.

Pupil Teachers at end of Third Year.

FIRST PAPER.

Three hours and a half allowed.

Euclid.

MALES.

(All generally understood abbreviations for words may be used, but not symbols of operation, such as −, +, ×.)

Answer two questions, including No. 3, if you can.

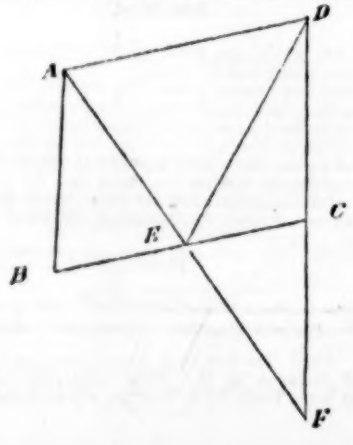
1. If one side of a triangle be produced, the exterior angle is greater than either of the interior opposite angles.

Euclid, Book I., Prop. 16.

2. If a straight line, falling upon two other straight lines, make the exterior angle equal to the interior and opposite upon the same side of the line; or make the interior angles upon the same side together equal to two right angles; the two straight lines shall be parallel to one another.

Euclid, Book I., Prop. 28.

3. E is the middle point of BC, a side of the parallelogram ABCD, and AE, DC produced meet in F; prove that the triangle DEF is half of the parallelogram ABCD.



Because the parallelogram ABCD and △AED are on same base AD, and between same parallels AD and BC;

∴ Parallelogram is double of △AED.

∴ △'s AEB, BEC together = ½ parallelogram.

Again: in △'s AEB, CEF, ∠AEB = ∠CEF (I. 15), and ∠BAE = ∠CFE (I. 29), and BE = EC (Hyp.)

∴ △AEB = △CEF (I. 26.)

To each add △DEC.

∴ △'s AEB, DEC = △'s DEC, CEF.

But △'s AEB, DEC are half parallelogram ABCD.

∴ △'s DEC, CEF, *i.e.*, △DEF = half parallelogram ABCD.

Q. E. D.

Algebra.

Answer two questions, including question 2, if you can.

1. Show that $(2a+3b-4c)^2-(2a-3b+4c)^2=8a(3b-4c)$, and prove it for the case when $a=\frac{1}{2}$, $b=-\frac{1}{3}$, $c=\frac{1}{4}$.

$$(2a+3b-4c)^2-(2a-3b+4c)^2=8a(3b-4c)$$
$$\{(2a+3b)-4c\}^2-\{(2a-3b)+4c\}^2$$
$$=\{(2a+3b)^2-8c(2a+3b)+16c^2\}-\{(2a-3b)^2+8c(2a-3b)+16c^2\}$$
$$=\{4a^2+12ab+9b^2-16ac-24ab+16c^2\}-\{4a^2-12ab+9b^2+16ac-24ab+16c^2\}$$
$$=24ab-32ac$$
$$=8a(3b-4c)$$

$$(2a+3b-4c)^2-(2a-3b+4c)^2=8a(3b-4c)$$
$$=(1-1-1)^2-(1+1+1)=4(-1-1)$$
$$=\quad 1-9\quad =-8$$
$$=\quad -8\quad =-8$$

2. Prove the rule for finding the G. C. M. of two algebraical expressions.

Simplify $\dfrac{x^2-(b+c)x+bc}{x^2+(b-c)x-bc}$.

Let A and B represent any two algebraical expressions. Divide A by B and C, so as to obtain D the last divisor without a remainder.

B)A(x
xB
C)B(y
yC
D)C(z
zD

From the example we get

A = xB + C, B = yC + D, C = zD.

D is a common measure of A and B.

For ∵ C = zD, D is a measure of C, and D measures yC, and it measures itself.

∴ D measures yC + D, *i.e.*, B. It also measures any multiple of B. ∴ it measures xB, and it has been shown to measure C; ∴ it measures xB + C, *i.e.*, A.

D. is the G. C. M.

For every measure of A and B measures their diff., *i.e.*, C; so every common measure of A and B is a common measure of B and C. Similarly every common measure of B and C is a common measure of C and D. So every common measure of A and B is a measure of D. But D is the highest number which can measure D.

∴ D is the G. C. M. of A and B.

$$\frac{x^2-(b+c)x+bc}{x^2+(b-c)x-bc}$$
$$=\frac{x^2-bx-cx+bc}{x^2+bx-cx-bc}$$
$$=\frac{(x-b)(x-c)}{(x+b)(x-c)}$$
$$=\frac{x-b}{x+b}.$$ Ans.

3. Solve the equations—

(1) $\frac{5}{11}(x-5\frac{1}{2})-\frac{1}{2}(x-\frac{5}{11})-\frac{5}{11}(\frac{5}{2}-\frac{11}{2})=0.$

(2) $\dfrac{x+19}{x+12}-\dfrac{3x+4}{2x+1}+\dfrac{1}{2}=0.$

(1) $\frac{5}{11}(x-5\frac{1}{2})-\frac{1}{2}(x-\frac{5}{11})-\frac{5}{11}(\frac{5}{2}-\frac{11}{2})=0$

$$=\left(\frac{2x}{11}-1\right)-\left(\frac{11x}{2}-1\right)-(\tfrac{5}{2}-1)=0$$
$$=\frac{2x}{11}-\frac{11x}{2}=1-1-\tfrac{1}{2}$$
$$=4x-121x=-13$$
$$=117x=13$$
$$=x=\tfrac{1}{9}$$ Ans.

(2) $\dfrac{x+19}{x+12}-\dfrac{3x+4}{2x+1}+\dfrac{1}{2}=0$

$$2(x+19)(2x+1)-(3x+4)(x+12)2=-(x+12)(2x+1)$$
$$4x^2+78x+38-6x^2-80x-96=-2x^2-25x-12$$
$$4x^2-6x^2+2x^2+78x-80x+25x=-12-38+96$$
$$23x=46$$
$$x=2 \text{ Ans.}$$

Mensuration.

Answer one question.

1. State and prove the rule for finding the area of a parallelogram.

The area of each of the 64 squares of a chess-board is 2·89 inches, and the outer rim of the board is ·2 of an inch wide: find the length of a side of the board.

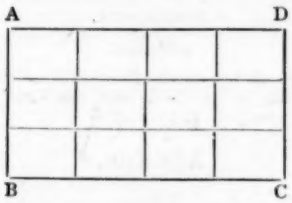
Rule.—Multiply the length by the perpendicular breadth, and the product will be the area.

A rectangular parallelogram is thus equal to any parallelogram on the same base and between the same parallels.

Euclid, Book I., Prop. 35.

To find the area of a rectangle, multiply the length by its breadth. For let x and y be the number of units in the two sides of a rectangle, ABCD; it is clear there will be as many times x units as there are units in y; *i.e.*, as many square units as x times y.

Hence the rule, multiply the length by the breadth.



Area of one square = 2·89 inches,
$\therefore$ side of " $= \sqrt{2\cdot89} = 1\cdot7$
And length of side $= (1\cdot7 \times \sqrt{64}) + (\cdot2 \times 2)$
$= 13\cdot6 + \cdot4$
$= \underline{14 \text{ inches.}}$

2. State the rule for finding the area of a triangle, of which the three sides are given.

Find the area of a triangle whose sides are 12, 15, 17 chains.

Rule.—From half the sum of the three sides subtract each side separately, then multiply the half sum and the three remainders together and the square root of the product will be the area.

$$(12+15+17)\tfrac{1}{2} = \tfrac{44}{2} = 22$$
$$\sqrt{22(22-12)(22-15)(22-17)}$$
$$= \sqrt{22 \times 10 \times 7 \times 5}$$
$$= \sqrt{4{,}200}$$
$$= 87\cdot75 \text{ chains} = 8\cdot775 \text{ acres}$$
$$= \underline{8 \text{ acres, 3 roods, 4 poles, nearly.}}$$

Arithmetic.

FEMALES.

1. Divide ·15 by 30, 1500 by ·005, ·015 by ·003. Prove the *second* result by vulgar fractions.

$$\cdot15 \div 30 = \cdot015 \div 3 = \underline{\cdot005}. \text{ Ans.}$$
$$1500 \div \cdot005 = 1500{,}000 \div 5 = \underline{300{,}000.} \text{ Ans.}$$
$$\cdot015 \div \cdot003 = 15 \div 3 = \underline{5.} \text{ Ans.}$$
$$= \frac{15}{1}\frac{00}{00} \div \frac{3}{1000}$$
$$= \frac{15}{1}\frac{00}{00} \times \frac{1000}{3}$$
$$= \underline{300{,}000.} \text{ Ans.}$$

2. Find the value of ·375 of a guinea + ·1875 of a crown + ·3 of 7s. 6d. − ·875 of 2d.

·375 guinea + ·1875 cr. + ·3 of 7s. 6d. − ·875 of 2d.

21	5	90	2
375	·9375	27·0	1·750
750	12		
7·875	11·2500		
12			
94·500			

$$= 94\cdot5 + 11\cdot25 + 27 - 1\cdot75$$
$$= 131\text{d.}$$
$$= \underline{10\text{s. } 11\text{d.}} \text{ Ans.}$$

3. If A can mow a field of grass in $7\frac{1}{2}$ days, and B can do $\frac{3}{5}$ of the same field in $9\frac{1}{2}$ days, in what time can A and B together mow the whole field?

$$\text{A does } \frac{1}{7\frac{1}{2}} = \tfrac{2}{15} \text{ per day;}$$
$$\text{B " } \frac{\frac{3}{5}}{9\frac{1}{2}} = \tfrac{6}{95} \text{ "}$$
$$\text{A and B do } \tfrac{2}{15} + \tfrac{6}{95} = \frac{38+18}{285} = \tfrac{56}{285}$$
$$\text{Time for } \tfrac{56}{285} = 1 \text{ day,}$$
$$\text{" } \tfrac{1}{285} = \tfrac{1}{56}$$
$$\text{" } \tfrac{285}{56} = \frac{1 \times 285}{56}$$
$$= \underline{5\tfrac{5}{56} \text{ days.}} \text{ Ans.}$$

4. What decimal fraction of £1 must be added to ·65 of £6 13s. 4½d., that the result may be 15 shillings?

$$\frac{15\text{s.} - \cdot65 \text{ of } £6\ 13\text{s. } 4\tfrac{1}{2}\text{d.}}{20\text{s.}}$$
$$= \frac{15\text{s.} - \frac{65}{100} \text{ or } \frac{13}{20} \text{ of } £6\ 13\text{s. } 4\tfrac{1}{2}\text{d.}}{20\text{s.}}$$
$$= \frac{15\text{s.} - 12\text{s. } 1\tfrac{1}{2}\text{d.}}{20\text{s.}}$$
$$= \frac{2\text{s. } 10\tfrac{1}{2}\text{d.}}{20}$$
$$= \tfrac{29}{160}$$
$$= \underline{\cdot14375.} \text{ Ans.}$$

Grammar.

1. 'These feelings I shared in common with the humblest pilgrim that was kneeling there, and, in some respects, he had even the advantage of me; he had made infinitely greater sacrifices than I had done, and undergone far heavier toils to reach that bourne. Undistracted by mere temporal associations, *he* only saw the sacred spot wherein the Prophets preached, and David sung, and Christ had died.'

Paraphrase this passage.

2. Point out the subordinate sentences in it, analyse the two first, and parse the second of them.

While viewing that holy place, the feelings which came over me were similar to those which were entertained by the lowliest visitor to the city, and yet perhaps his were in some respects deeper and more intense than mine, for he had toiled harder, suffered more, and striven more earnestly in order to reach that spot than I myself. No earthly surroundings, no consideration of anything he had suffered marred his devotion. He thought only of the spot whereon he knelt, as the place where of old seers had prophesied, David had sung, and Christ had been crucified.

Subordinate sentences:—
(1) Adj. sent. That was kneeling there.
(2) Adv. sent. of manner. Than I had done.
(3) Adj. sent. Wherein the Prophets preached.
(4) Adj. sent. And David sung.
(5) Adj. sent. And Christ had died.

(1) Subject: That.
Predicate: kneeling.
Ext. of Pred.: there (place).
(2) Connective: Than.
Subject: I.
Predicate: had done.

Than—cop. conj., joining the two sents., 'He had made more sacrifices' and 'I had done.'
I—pers. pro., masc., sing., 1st, nom. to *had done*.
had—aux. verb to *done*, indicating pluperfect tense.
done—past part. of *to do*.
had done—irr. int. verb, act., ind., pluperfect, 1st, sing., agreeing with *I*.

3. What are the means of readily distinguishing between words of English and of Latin origin? Take your examples from the above passage.

English words may be known (*a*) by their length, (*b*) their grammatical use, (*c*) the way in which they are inflected, (*d*) by their component parts, (*e*) their spelling, (*f*) their meaning.

(*a*) Nearly all monosyllables are English. Of the forty-three monosyllables in the passage all except—preach, toils, bourne, mere, are English.

(*b*) All the conjunctions, prepositions, and distinguishing adjectives are English.

(*c*) The irregular verbs—was, had, made, done, saw, sung, and the regular verbs 'shared' and 'died,' are English.

Nouns which have their plural formed by vowel changes, and adjectives irregularly compared, are English.

(*d*) If words are made up of double monosyllables in common use, they are E., as 'undergone.'

(*e*) Words beginning with wh, kn, gn, sh, gh, as 'kneeling,' are E.

(*f*) Common things, and the names of things first used by people, are E.

Words connected with military stations, the church, law, the chase, and feudalism, or such as are connected with science, philosophy, or classical literature, and names of foreign plants, animals, are of Latin origin. Examples from passage—pilgrim, advantage, sacrifices, distracted, temporal, association.

Geography.

(*Answer two Questions and draw one map.*)

1. Draw a map of one of the following:

(*a*) China
(*b*) The Basin of the Nile
(*c*) The coast line from Suez to Calcutta.

2. A traveller goes from Calcutta to Teheran. State what countries he would traverse, what towns he would visit, his modes of locomotion, and the manners and customs of the natives in the countries traversed.

He would pass through Bengal, the North-west Provinces, and Punjaub, along the Ganges or by railway, calling at Patna, Benares, Allahabad, Cawnpore, Delhi, and Peshawur. He would then go through the Khyber Pass on horseback to Cabul, through Afghanistan to Herat. Then skirting along the north of Khorassan along with a caravan, he would pass Meshed, Abassabad, and Daulatabad, before reaching Teheran in Persia.

In India, the inhabitants are Hindoos, and are simple in their habits, and live principally upon vegetable food. Their houses are built of unburnt bricks, and are tiled. There is little furniture, the people sitting on mats on the floor. In each village there is a temple, and a bazaar, where an annual fair is held. They are not very dark-skinned, have oval faces and expressive eyes. They worship millions of gods, and one of their institutions is that of *caste*, the members of which do not intermingle with each other. They till the soil rudely, growing rice, cotton, indigo, and opium, and some are engaged in making cotton, woollen, and silk goods, and carpets.

Many of the tribes of Afghanistan are nomadic, and those of the hill districts live largely by plunder, or by attending to their sheep, camels, and horses. By means of the latter, all the carrying trade is performed. In appearance, they resemble Jews, but dress like the Persians. They manufacture a little cotton, wool, and silk, for their own use, and export madder, fruits, furs, and shawls. They are fierce, cruel, dishonest, and untruthful.

The Persians in the towns are a lively, active, polite, and intelligent people, of the Mahometan religion chiefly, although there are some fire-worshippers. There are large numbers of nomadic tribes, especially in Kurdistan and the North-West provinces of the country. The people generally are fond of luxury and show, in both their dress and habitations.

3. State what you know of recent discoveries in Equatorial Africa.

Till within the last thirty years, the interior of Africa was unknown. Since then Sir Samuel and Lady Baker, Grant, Speke, and Burton from the North, and Livingstone, Stanley and Cameron from the South, have explored nearly the whole of the district, and have shown it to consist of a series of plateaus of rich and varied aspect, among which are a series of large fresh-water lakes, the Victoria Nyanza, the Albert Nyanza, Tanganyika, Nyassa, and others. These lakes or the regions round about them are the sources of the Nile and the Congo, the two largest rivers of Africa. The latter, explored by H. M. Stanley after his search for Livingstone, whom he had found near one of the lakes, is 2,000 miles long, and drains an area of probably 800,000 square miles, having 3,000 miles of navigable course in the main and branch streams. The new Congo State, the king of the Belgians at the head, has just been formed, while Livingstonia in the interior has been selected as the place for missionary operations by several religious bodies.

4. Say what you know of the causes of

(*a*) Ocean currents.
(*b*) Winds.

How is commerce affected by (*a*) or (*b*) or both.

The heat of the Torrid Zone affects the specific gravity of the waters there, and a greater evaporation takes place there than in any other region. The consequence is that a cold under-current sets in from the Poles to restore the equilibrium. As they cannot at once attain the velocity of the earth at that part, they fall behind and become south and north-westerly, in which directions they are helped by the Trade Winds. These primary currents are modified in their direction, velocity, volume, and temperature by the coast, the form of bottom and other causes.

Winds, as waves, are caused by variations of temperature. The great heat of the tropics induces a colder current from the colder regions, and the north and south currents are converted into north-easterly and south-easterly by the rotation of the earth. The varied heat of the land and water, and their facility of reception and radiation create the land and sea breezes.

Commerce is assisted or hindered according as advantage can or cannot be taken of the winds and currents, *e.g.*, the voyage to America can be performed in less time than the voyage from America, and so freights are less one way than the other.

SECOND PAPER.

Two hours and a half allowed.

Needlework.

FEMALES.

(The Needlework Specimens will be collected by the Inspector at the expiration of one hour after the distribution of the Examination Paper.)

Arithmetic.

MALES.

1. Which would be the more advantageous—to sell goods for £810 ready money, or for £830 to be paid 9 months hence, discount being at the rate of 5 per cent. per annum?

£100 in 9 mos. would yield $\frac{3}{4}$ of 5 = £$3\frac{3}{4}$
P. W. of £830 =
£ £ £
As $103\frac{3}{4}$: 830 :: 100 : x
$= \frac{100 \times 830 \times 4}{415}$
= £800
£810 − 800 = £10 gain by selling for ready money. Ans.

2. A man who has £4710 stock in the Three per Cents. sells out at $100\frac{1}{8}$, but on the stocks falling $2\frac{1}{4}$ per cent. he reinvests the amount received; what increase will there be in his income, the usual brokerage being charged on each transaction?

£4710 in 3 per Cents. yields $\frac{4710 \times 3}{100}$ = £141 6s.
For every £100 stock he gets $100\frac{1}{8} - \frac{1}{8}$ brokerage or £100.
Proceeds of sale = $\frac{4710 \times 100}{100}$ = 4710.
$100\frac{1}{8} - 2\frac{1}{4} = 98$. $98 + \frac{1}{8}$ brokerage = $98\frac{1}{8}$ price of stock.
Second income = $\frac{4710 \times 3}{98\frac{1}{8}}$
= £144.
Change in income = £144 − £141 6s. = £2 14s. gain. Ans.

3. Find the exact square roots $38\frac{1}{16}$ and of 5·4.

$\sqrt{38\frac{1}{16}} = \sqrt{\frac{609}{16}} = \frac{\sqrt{609}}{4} = 6{\cdot}16$. Ans.
$\sqrt{5{\cdot}4} = \sqrt{5\frac{4}{9}} = \sqrt{\frac{49}{9}} = \frac{7}{3} = 2{\cdot}3$. Ans.

4. A and B are to get 69s. for a piece of work, at which A works $7\frac{1}{2}$ days and B $8\frac{1}{2}$ days; if A does as much in 5 days as B does in 6 days, how should the money be divided amongst them?

B does $\frac{4}{5}$ of the work A does in 1 day
Units of work done by A = $7\frac{1}{2}$
B = $\frac{4}{5} \times 8\frac{1}{2} = \frac{34}{5} = 6\frac{4}{5}$
Their shares will be as $7\frac{1}{2}$: $6\frac{4}{5}$
or 60 : 55
or 12 : 11
∴ A's share = $\frac{12}{23}$ of 69s. = 36s. Ans.
B's ,, = $\frac{11}{23}$ of 69s. = 33s. Ans.

History.

MALES AND FEMALES.

1. What monarch of Scotland ascended the English throne? Explain his title to it.

James I. of Scotland succeeded Elizabeth on the throne of England in 1603. He was the nearest relative to Elizabeth in direct descent from Henry VII., the first of the Tudors. Henry VII. was succeeded by his son, Henry VIII., and his eldest daughter, Margaret, married James IV., King of Scotland. Henry VIII. had three children, Edward VI., Mary, and Elizabeth, none of whom had issue. Consequently the Crown reverted to the descendants of Margaret, of whom James was the representative. Margaret had issue James V.; James had issue Mary, Queen of Scots; and Mary had issue James VI. of Scotland and I. of England.

2. Who was Oliver Cromwell? Briefly sketch his character and career.

Oliver Cromwell was a small landed proprietor of Huntingdonshire, who became Member of Parliament for Huntingdon during the reign of Charles I. When Parliament quarrelled with Charles, Cromwell joined the army of the former and gained victories over the King's forces at Grantham, Marston Moor, and Newbury; afterwards, under Fairfax, the battle of Naseby. He took part in the 'purging' of the House of Commons, and became one of the Commissioners for the trial of Charles. He afterwards defeated the Scotch at Dunbar, and Charles II.'s forces at Worcester. Then he expelled the Rump Parliament, was made Lord Protector of the Commonwealth, and died in 1659.

The character of Cromwell is variously drawn. He had a strong will, great personal force of character, and the ability to infuse his own spirit into those who worked with him. He has been accused of being ambitious and fond of power. He was decidedly religious, and protected the weak against the strong. He made his enemies to fear him, and was eminently patriotic. He had literary tastes, and yet was fond of athletic exercises, was firm in his government, orderly in the management of his affairs, and his power was such as to cause his aid to be sought by the sovereigns of Europe.

3. Blenheim, Ramillies, Dettingen, Torres Vedras, Waterloo. What illustrious actions do these names recall?

Blenheim, a village in Bavaria, where Marlborough and Prince Eugene gained a signal victory over the French in 1704.
Ramillies, in S. Brabant, another great victory by Marlborough over the French, 1706.
Dettingen, 1743, the scene of the last battle in which a King of England took a personal part, George II. defeating the French.
Torres Vedras, in Estremadura, Portugal, the centre of the military lines formed by Wellington in 1810, to resist the approach of the French.
Waterloo, in Belgium, the last great battle of Napoleon Bonaparte, June 18, 1815, when he met Wellington, and was defeated, and afterwards taken prisoner.

Teaching.

Write the notes of a lesson on a coal-mine.

Materials required to illustrate the lesson:—A piece of coal, blackboard, and model of coal-mine if possible.

I. *Introduction.*—Speak of materials used for fires, wood, coal, coke. Dearth of wood required people to seek for other source of heat. Coal discovered in various parts of the country.

II. *Parts of a mine.*—(*a*) The *shaft*; (*b*) the *seams*.

(*a*) Before sinking a coal-mine, presence of coal ascertained by *boring*. (Draw a *drill* on blackboard, and show that as the hole is made it is ascertained what materials the drill has passed through.) A *shaft* or *pit* is then dug down to the coal *or lower* (to allow for the accumulation of water), the lower part being the *sump*. The sides of the shaft filled with frame-work to allow cages to slide up and down. The shaft in two portions to allow cages to pass, and also in some cases for the passage of fresh air down one and foul air up the other.

(*b*) *The seams.*—Several layers of coal are sometimes found in one mine, with a layer of rock or earth between each two. (Show model, draw on blackboard, and use a heap of slates, drawing away every fourth or fifth slate. Use little blocks or pieces of chalk to hold up the rest.) Miners work out the coal, leaving pillars to hold up the roof. When the mine is about to be disused these pillars are taken away.

III. *Workers and method of working.*—The man who cuts the coal is called a *hewer* or miner; the boy who pushes or *puts* the coals in the little tubs which run on wheels is called a *putter*. When the tubs or waggons have a long distance to travel, a boy is employed to drive a horse with tubs, and he is called the *driver*. Besides these there are *overmen*, *deputy-overmen*, and *shifters*, these latter removing everything which is needed to enable the miners to work. The hewer hews the coal with a pick. He then fills the tub, which, by the putter and driver, or, in extensive mines, by the engine, is brought to the foot of the shaft. Here the tubs are placed in a cage and drawn up to the surface by an engine. Miners use safety lamps.

IV. *Dangers of a mine.*—From (*a*) explosion of gas; (*b*) falls of roof; (*c*) accidents to machinery; (*d*) way of escape being cut off; (*e*) fire damp.

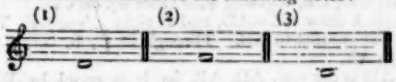
Music.

OLD NOTATION.

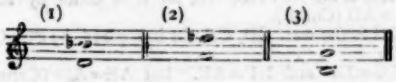
A quarter of an hour allowed for this paper.

(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.

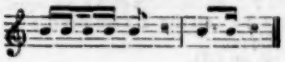
1. Write minor sixths above the following notes:—



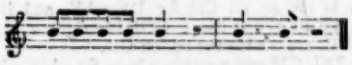
1.



2. Re-write the following, doubling the value of every note and rest:—



2.



3. Explain (briefly) the following terms:—(1) M. 100; (2) *Dal Segno*; (3) *Staccato*.

3. (1) Metronome making 100 beats in a minute; (2) repeat from the sign 𝄋; (3) crisply, cut short, detached.

TONIC SOL-FA NOTATION.

1. Write minor sixths above the following notes:—(1) *ray*; (2) *fah*; (3) te_1.

1. (1) *ta*; (2) ra^1; (3) *soh*.

2. Re-write the following in four-pulse measure, doubling the value of each note and rest:—

|s ,l .s ,f :m . |s .,f :m .s ‖

2.

|s .l :s .f |m : |s :- .f |m :s ‖

3. Explain (briefly) the following terms:—(1) M. 100; (2) *Dal Segno*; (3) *Staccato*.

3. (1) Metronome making 100 beats in a minute; (2) repeat from the sign 𝄋; (3) crisply, cut short, detached.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year.

FIRST PAPER.

Three hours and a half allowed.

Euclid.

MALES.

[The only abbreviation admitted for 'the square on AB' is 'sq. on AB,' and for 'the rectangle contained by AB and CD,' 'rect. AB, CD.' All generally understood abbreviations for *words* may be used, but not symbols of operation, such as ∴, +, ×.]

(*Answer two Questions, including No. 3, if you can.*)

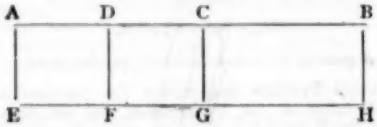
1. If a straight line be divided into any two parts, the rectangle contained by the whole and one of the parts is equal to the rectangle contained by the two parts, together with the square on the aforesaid part.

Euclid, Book II., Prop. 3.

2. If a straight line be divided into any two parts, the squares on the whole line, and on one of the parts, are equal to twice the rectangle contained by the whole and that part, together with the square on the other part.

Euclid, Book II., Prop. 7.

3. In a straight line AB any point C is taken, and AC is bisected at D. Prove that the rectangle AD, AB, is equal to the rectangle CD, CB, together with twice the square on CD.



In AB take any point C : bisect AC in D. Then rect. AD, AB = rect. CD, CB, together with twice sq. on CD.

Through A draw AE = AD, and at right ∠'s to AB. Through E draw EH parallel to AB. Through D, C, B, DF, CG, BH parallel to AE.

Then AH is the rect. AD, AB, for it is contd. by BA, AE and AE = AD (Const.).

And CH is the rect. CD, CB, for it is contd. by BC, CG, and CG = CD.

For CG = DF and DF = AE. But AE = AD (Const.), and AD = DC (Hyp.).

And ∵ AE = AD, and the opposite sides and ∠'s of parallelograms are equal ; ∴ all the sides of AF are equal, and the angle DAE is a right ∠ ; ∵ all the ∠'s are right ∠'s and AF is a sq. And AD = CD (Hyp.).

∴ AF is the sq. on CD.

And DG is the sq. on CD, for DF = AE, and it has been shown that AE = CD and the ∠ CDF is a right ∠ (I. 29).

∴ AF, DG, are double the sq. on CD.

But AF, DG, CH make up the whole fig. AH, which is the rect. AD, AB.

Wherefore, etc. Q.E.D.

Algebra.

(*Answer two Questions, including Question 2, if you can do so.*)

1. Find the G. C. M. of x^3-2x^2+2x-1 and $x^4-3x^3+2x^2+x-1$, and show that its square is a factor of the latter expression.

$x^3-2x^2+2x-1)x^4-3x^3+2x^2+x-1(x-1$

$\quad x^4-2x^3+2x^2-x$

$\quad -x^3+2x-1$

$\quad -x^3+2x^2-2x+1$

$-2) \quad -2x^2+4x-2$

$x^2-2x+1)x^3-2x^2+2x-1(x$

$\quad x^3-2x^2+x$

$\quad x-1$

$x-1)x^2-2x+1(x-1$

$\quad x^2-x$

$\quad -x+1$

$\quad -x+1$ G. C. M. = $\underline{x-1}$.

Sq. of $x-1=(x-1)(x-1)$

$x^4-3x^3+2x^2+x-1$ may be thus resolved into factors.

$= x^2(x^2-3x+2)+(x-1)$

$= x^2(x-1)(x-2)+(x-1)1$

$= (x-1)\{x^2(x-2)+1\}$

$= (x-1)(x^3-2x^2+1)$

$= (x-1)(x-1)(x^2-x-1)$,

And contains $(x-1)^2$.

2. Prove that $\frac{a}{b}\times\frac{c}{d}=\frac{ac}{bd}$, where the letters represent any numbers.

Take $\frac{a^3-ab+b^2}{a-b}$ from $\frac{a^3+ab+b^2}{a+b}$; and simplify

$$\frac{x^2}{4(2x-3)}-\frac{x^3}{(2x-3)^2}+\frac{x^4}{(2x-3)^3}.$$

Let $\frac{a}{b}$ when standing for any Nos. $=x$.

Also let $\frac{c}{d}=y$.

Then $a=bx$ and $c=dy$.

$\therefore a\times c=bx\times dy$;

i.e., $ac=bdxy$.

Divide both sides by bd.

$\therefore \frac{ac}{bd}=xy$.

But $xy=\frac{a}{b}\times\frac{c}{d}$, for $\frac{a}{b}=x$ and $\frac{c}{d}=y$.

$\therefore \underline{\frac{a}{b}\times\frac{c}{d}=\frac{ac}{bd}}$

$$\frac{a^3+ab+b^2}{a+b}-\frac{a^3-ab+b^2}{a-b}$$

$$=\frac{(a-b)(a^3+ab+b^2)-(a+b)(a^3-ab+b^2)}{(a+b)(a-b)}$$

$$=\frac{(a^3-b^3)-(a^3+b^3)}{a^2-b^2}$$

$$=\underline{\frac{2b^3}{a^2-b^2}}. \text{ Ans.}$$

$$\frac{x^2}{4(2x-3)}-\frac{x^3}{(2x-3)^2}+\frac{x^4}{(2x-3)^3}$$

$$=\frac{x^2(2x-3)^2-4x^3(2x-3)+4x^4}{4(2x-3)^3}$$

$$=\frac{4x^4-12x^3+9x^2-8x^4+12x^3+4x^4}{4(2x-3)^3}$$

$$=\underline{\frac{9x^2}{4(2x-3)^3}}. \text{ Ans.}$$

3. Solve two of the following equations:—

(1) $\begin{cases}\frac{3x}{4}-\frac{5y}{8}=-1.\\ \frac{5x}{6}+\frac{y}{4}=14.\end{cases}$

(2) $x^2+px-q=0$.

(3) $(21x+10)(x-1)+4=0$.

(1) $\begin{cases}\frac{3x}{4}-\frac{5y}{8}=-1.\\ \frac{5x}{6}+\frac{y}{4}=14\end{cases}$

$6x-5y=-8$

$10x+3y=168$

$60x-50y=-80$

$60x+18y=1008$

$-68y=-1008$

$y=\underline{16}$. Ans.

$6x-80=-8$

$6x=72$

$x=\underline{12}$. Ans.

(2) $x^2+px-q=0$

$x^2+px=q$

$x^2+px+\left(\frac{p}{2}\right)^2=q+\frac{p^2}{4}$

$x+\frac{p}{2}=\pm\sqrt{q+\frac{p^2}{4}}$

$\underline{x=-\frac{p}{2}\pm\sqrt{q+\frac{p^2}{4}}}$. Ans.

(3) $(21x+10)(x-1)+4=0$

$21x^2-11x-10+4=0$

$21x^2-11x=6$

$x^2-\frac{11}{21}x+(\frac{11}{42})^2=\frac{6}{21}+\frac{121}{1764}$

$x-\frac{11}{42}=\pm\frac{23}{42}$

$x=\pm\frac{23}{42}+\frac{11}{42}$

$=\frac{2}{3}$ or $-\frac{1}{2}$. Ans.

Mensuration.

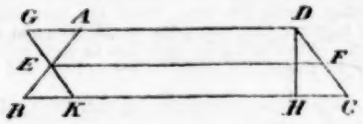
(*Answer one Question.*)

1. State and prove the rule for finding the area of a trapezoid (a quadrilateral having two sides parallel.)

Find the cost of boarding a floor in the form of a trapezoid, whose parallel sides are 16 ft. 8 in. and 14 ft. 10 in., and the distance between them 8 ft. 4 in., at 3½d. per foot.

Rule.—Multiply half the sum of the parallel sides by the perpendicular height, and the product will be the area of the trapezoid,

Bisect AB in E. Though E draw GK parallel to DC. Produce DA to meet GK in G.



Then GC is a parallelogram, and, by Euclid I. 15, 29, 26, △ EAG = △ EBK, and parallelogram GC = trapezoid ABCD, and sides GD, KC = sides AD, BC.

But GD = KC. ∴ GD = ½ AD, BC.

And area of parallelogram GC is found by mult. side by perpendicular height.

∴ Area of trapezoid is found by multiplying half sum of sides by perpendicular height.

$\frac{1}{2}$ (16 ft. 8 in. + 14 ft. 10 in.) × 8 ft 4 in. at 3½d.
$= \frac{1}{2}$(31 ft. 6 in.) × 8⅓ ft. at 3½d.
$= 15\frac{3}{4} \times 8\frac{1}{3} \times 3\frac{1}{2}$
$= \frac{63}{4} \times \frac{25}{3} \times \frac{7}{2}$
$= \frac{11025}{24}$
$= \underline{£1\ 18s.\ 3\frac{3}{4}d.}$ Ans.

2. What is the rule for finding the area of a sector of a circle?

Find the circumference of a circle whose area is half an acre.

If the length of the arc be given—

Rule.—Multiply half the length of the arc by the radius of the circle, and the product is the area of the sector.

If the angle of the sector be given—

As 360° : degrees in angle of sector :: area of circle : area of sector.

Circumference $= \sqrt{2420 \times \frac{22}{7}}$
$= \sqrt{\frac{53240}{7}}$
$= \sqrt{30422{\cdot}857142}$
$= \underline{174{\cdot}42 + \text{yds.}}$ Ans.

Arithmetic.

FEMALES.

1. If 575 men can perform a piece of work in 180 days of 10 hours each, how many days will it take 115 men if they work 9 hours a day?

men 115 : men 575 :: 180 days : 1000 days. Ans.
hrs. 9 : hrs. 10

2. At what rate per cent. must a person invest £280 so that in 7 months it shall amount to £285 14s. 4d.?

£280 : £100 :: £5 14s. 4d. : £3 10s. 0d. Ans.
mos. 7 : mos. 12

3. The population of a town in 1881 was 35,076, and this showed an increase on that in 1871 of 20 per cent. Find the population in 1871.

Population of 1881 is represented by 100 + 20 = 120. Population of 1871 by 100.

120 : 100 :: 35,076 : 29,230. Ans.

4. What sum of money must be invested in 5½ per cent. stock at 83 to enable the possessor to realise an income of £64 3s. 4d. per calendar month?

£64 3s. 4d. × 12 = £770 per year.
£83 invested yields £5½ int.
∴ £5½ : £770 :: £83 : £11,620. Ans.

Grammar.

MALES AND FEMALES.

1. 'The Poet, fostering for his native land
Such hope, entreats that servants may abound
Of those pure altars worthy; ministers
Detached from pleasure, to the love of gain
Superior, insusceptible of pride,
And by ambitious longings undisturbed;
Men whose delight is where their duty leads
Or fixes them; whose least distinguished day
Shines with some portion of that heavenly lustre
Which makes the Sabbath lovely in the sight
Of blessed angels, pitying human cares.'

Paraphrase this passage.

Deeply anxious for the welfare of his country, the Poet earnestly prays that there may always be found in his native land those who will be worthy of the high honour of serving at her altars. He prays that her ministers may accept their office not because of the profit or the pleasure they may derive from it, nor because proud of the honour it brings and the means it gives them of gratifying their ambition, but that they may nobly discharge the duties which its acceptance involves whenever and wherever such duties may the found, and whose every day life shall reflect some of the loveliness and purity and goodness which causes the Sabbath to be looked upon with gladness by those bright intelligences who pity human miseries.

2. Point out the subordinate sentences in it, and analyse and parse fully the noun sentence. Point out also any adjectives of Latin origin.

(*a*) Noun sentence: That servants may abound of those pure altars worthy.

(*b*) *Ministers.....undisturbed* is also a similar noun sentence, or is a phrase of which the word *minister* is in apposition with *servants*.

(*c*) *Men.....them:* ditto.

(*d*) Adv. sent. of place: Where their duty leads.

(*e*) Adv. sent. of place: Or fixes them.

(*f*) Adj. sent.: Whose least day.....lustre.

(*g*) Adj. sent.: Which makes .....cares.

That—cop. conj., joining the two sent., 'The poet entreats' and 'Servants may abound.'

servants—com. noun, masc., plur., nom. to 'May abound.'

may—reg. intrans. verb, aux. to *abound*, indicating pot. mood.

abound—reg. intrans. verb, act., ind. pres., gov. by *may*.

may abound—reg. intrans. verb, act., pot. pres., 3rd, plur., agreeing with *servants*.

of—prep. showing rel. between *worthy*, and *altars*.

those—list. adj. plural, limiting *altars*.

pure—adj. of quality, qual. *altars*.

altars—com. noun, neut., pl., obj., gov. by *of*.

worthy—adj. of quality, qual. *servants*.

Adjectives of Latin origin: Superior, insusceptible, ambitious, undisturbed, distinguished, human.

3. State the various ways by which words of Latin origin have been introduced into our language.

Words have been introduced into England from the Latin at four different periods.

First.—During the Roman occupation of four hundred years.

Second.—From the mission of Augustine in 596 through the connection between the English and Roman Church till 1066, consisting chiefly of law terms, ecclesiastical and miscellaneous words.

Third.—From the Norman invasion, Latin words affected by their passage through the French, were introduced till 1480. They consisted of feudal, war, and hunting terms, titles, legal terms, and family and domestic words.

Fourth.—The revival of learning, and the religious and political changes of the 16th century added words direct from the Latin after the year 1480.

Geography.

(Answer *two* questions and draw *one* map.)

1. Draw a map of one of the following:—

(*a*) The Atlantic Ocean.
(*b*) The United States.
(*c*) The basin of the Amazon.

2. Name the principal productions, the chief seaports, and the chief manufacturing towns of the countries touching

(*a*) The Gulf of Mexico.
(*b*) The Arabian Sea.
(*c*) The China Sea.

(*a*) MEXICO.—*Productions.*—Maize, wheat, coffee, sugar, indigo, tobacco, cotton; mahogany and fancy timbers generally; fruits, gold, copper, silver in large quantities.

Ports.—Vera Cruz (Mexico), Sizal (Merida), Campeachy, Metamoros, Tampico.

Manufacturing towns.—None.

UNITED STATES.—*Productions.*—Cotton, wheat, maize, tobacco, sugar, rice, flax, iron, coal, lead, gold, silver.

Ports.—On Gulf: New Orleans, Galveston, Mobile; Charleston, Boston, Baltimore, New York.

Manufacturing towns.—Philadelphia, Pittsburg, New York, Baltimore, Harper's Ferry, Cincinnati, Lowell, Hartford, Springfield.

(*b*) ARABIAN SEA.—*Ports.*—Aden, Muscat, Mocha (on Red Sea.)

ARABIA.—*Productions.*—Coffee, dates, pearls, horses, dourah, gums, balsams, senna, castor oil.

Manufacturing towns—None.

BELOOCHISTAN.—*Productions.*—Dates.

Ports and *Manufacturing towns.*—None.

INDIA—*Productions.*—Rice, cotton, tea, sugar, poppy, pepper, indigo, tobacco, palms, banyan, teak, fruits, coffee, diamonds, coal.

Ports.—Kurrachee, Surat, Bombay, Mangalore, Madras, Calcutta.

Manufacturing towns.—Hyderabad, Surat, Moorshedabad, Dacca, Mirzapore, Patna, Musilapatam, Ahmedabad, Amritzir, Cashmere.

(*c*) CHINA.—*Productions.*—Rice, millet, tea, cotton, mulberry, camphor, sugar, rhubarb.

Ports.—Amoy, Canton, Foochew, Ningpo, Shanghai, Hankow, Tientsin.

Manufacturing towns.—Kiangsee, Nankin, Pekin, Hankow, Shanghai.

JAPAN—*Productions.*—Rice, mulberry, tea, cotton, varnish, and camphor.

Ports.—Yeddo, Osaka, Matsmai, Nangasaki.

Manufacturing towns.—Yeddo, Yokohama, Miyako.

3. Say what you know of the following:—

Berber, Formosa, Mandalay, Melbourne, St. Louis, Boston, Port Elizabeth, Mauritius, Mount Everest, Quito, Behring Strait, Khiva, Smyrna, Cook's Straits, Buenos Ayres, Vancouver's Island, Manilla, Kilima-Njaro, and Titicaca.

Berber.—A town in Egyptian Soudan, where the Atbara joins the Nile; 200 miles from Suakim on the Red Sea. Its present importance is its connection with the campaign of the English in the Soudan.

Formosa.—A large fertile island in the China Sea thickly populated.

Mandalay.—The capital of Burmah; a town of 100,000 inhabitants.

Melbourne.—The capital of Victoria, Australia, and one of the largest and most populous towns of Australia, well built and beautifully situated.

St. Louis.—The great wheat emporium of the United States on Mississippi.

Boston.—The largest port of the New England States.

Port Elizabeth.—The principal town and port of the eastern portion of Cape Colony.

Mauritius.—Small English island 600 miles east of Madagascar; produces sugar, rice, and ebony.

Mount Everest.—The highest mountain peak in the world; 29,000 feet; Himalayas, N. India.

Quito.—On the equator in South America, the highest town in the world.

Behring Strait.—The entrance from the Arctic to the Pacific Ocean, 36 miles across, between Asia and America.

Khiva.—Near the Oxus, capital of the Khanate of the same name, now owned by Russia.

Smyrna.—The chief port of Asia Minor, on the Archipelago, noted for its export of fruits.

Cook's Straits.—The passage between N. and S Islands, New Zealand, named after the navigator, Captain Cook.

Buenos Ayres (good air).—The chief port of La Plata, near the mouth of the R. La Plata.

Vancouver Island.—Off the W. coast of B. N. America, part of the Dominion of Canada; noted for coal and gold.

Manilla.—Capital of the Philippine Islands. Sends us large quantities of tobacco and hemp.

Kilima-Njaro.—The highest mountain of Central Africa.

Titicaca.—A large lake in Central America.

4.—Say what you know of the causes of the tides. How is London as a port affected by tidal influence?

The moon and sun attract the earth, but as the waters are movable, they are drawn on a heap on the side nearest the moon, and left behind on the side opposite from the moon. There are thus two periods of high water at each place on the earth's surface during the day. When the moon and the sun are acting together, then the tides are highest, and are called spring tides. When acting in opposition to each other, that is, when at right angles, the tides are not so high, and are called neap tides.

[*Note.*—Diagrams to illustrate spring and neap tides should accompany this answer.]

The Thames rises with spring tides to a height of from ten to twelve feet at London Bridge above its ordinary level. The consequence is that much larger vessels can sail up the river than would ordinarily be the case. Vessels however have to wait to take advantage of the flow or the ebb as they wish to enter or leave the river.

SECOND PAPER.

Two hours and a half allowed.

Needlework.

FEMALES.

The needlework specimens will be collected by the Inspector at the expiration of one hour after the distribution of the examination paper.

Arithmetic.

MALES.

1. A man buys 3 cwt. of tea for £40; if he sells one-fourth of it at 2s. 4d. per lb.; how must he sell the rest to make a profit on the whole of 8½ per cent.?

Cost price = 100. Gain = 8½. ∴ Selling price = 108½.

100 : 108½ :: £40 : £43 8

Selling price of 3 qrs. = 3 × 28 × 2s. 4d. = 9 16

" " (2¼ × 112) lbs. = £33 12s.

" " 1 lb. = £33 12s. / 252 = 2s. 8d. Ans.

2. A man borrows £600 at 5 per cent. per annum, and he pays back at the end of each year for interest and part repayment of capital, £80; how much would he owe after three such payments?

Int. for 1st year = $\frac{600 \times 5}{100}$ = £30.

£80 − £30 = £50 of principal repaid 1st year.

Int. for 2nd year = $\frac{550 \times 5}{100}$ = £27 10s.

£80 − £27 10s. = £52 10s. repaid 2nd year.

Int. for 3rd year = $\frac{£497\ 10s. \times 5}{100}$ = £24 17s. 6d.

£80 − £24 17s. 6d. = £55 2s. 6d. repaid 3rd year.

Amount still owing = £497 10s. − £55 2s. 6d.

= £442 7s. 6d. Ans.

3. If I invest in 4 per cent. debentures at £124¼, what per cent. do I get for my money, and what income should I receive by investing £3000, the usual brokerage being charged?

124 ¼ + ¼ : 100 :: 4 : *x*

or 125 : 100 :: 4 : *x*

or 5 : 4 :: 4 : 3⅕ p.c. Ans.

Income = £125 : £3000 :: £4 : £96. Ans.

4. State and explain the reason of the rule for converting a vulgar fraction into a decimal.

Rule.—Reduce the fraction to its lowest terms; place a dot after the numerator and affix ciphers; divide by denr. till there is no remr., or till the figures repeat. Place a dot in the quotient before as many figures as there are ciphers affixed to the numr.

When a cipher is attached to the right of a figure, it becomes ten times its former value; if two are attached, 100 times, and so on. When therefore we divide, the quotient is 10, 100, etc., times the proper value. By prefixing a dot before as many figs. as number of ciphers attached, we divide the quotient in the same way as the numr. was multiplied, and so give the quotient its proper value.

History.

MALES AND FEMALES.

(Answer three questions.)

1. During the early period of our history to what profession did men of learning generally belong? Name some of the most distinguished, and tell what you know of one of them.

To the priesthood. Among the most celebrated before the Conquest were the Venerable Bede, the writer of an Ecclesiastical History; Gildas, the first British historian; Dunstan, and Bishop Asser (life of Alfred the Great).

The Venerable Bede was born at Jarrow, in the county of Durham, between the years 672 and 677, and died in 735 A.D. He was educated for the priesthood, and founded the monastery at the place of his birth. His chief work was the Ecclesiastical History of England, from which, also, the best portion of our knowledge of the civil history of the country is derived. He wrote also many educational works, as well as a martyrology and theological works. His last great work was a translation into English of the Gospel of St. John. His remains are interred in the cathedral at Durham.

2. What varieties of administration are found among our colonies and dependencies? Classify the most important of them, and show how far each class depends upon the home government.

The general administration of the colonies is vested in the Colonial Office, at the head of which is one of the Chief Secretaries of State. To each of them a governor is appointed by the sovereign; but the amount of power which he has is different in different colonies, according as the principle of self-government has or has not been conceded to the inhabitants.

In colonies which have been acquired by settlement, the English law comes into force. In ceded colonies the laws formerly in use are allowed to prevail, but may be altered by the Queen in Council—*e.g.*, the French law prevails in Lower Canada and in some of the West Indies; and the Dutch laws to some extent at the Cape and in Guiana. In Australia, New Zealand, Cape Colony, and Canada there are representative institutions, generally a House of Assembly (or Representatives) and a Legislative Council, corresponding to our two Houses of Parliament. Those colonies which have no representative bodies are called Crown Colonies, and in these the Governor, assisted by a small Legislative Council, appointed by the Crown, exercises supreme power. Gibraltar, Malta, Mauritius, etc., are of this class.

3. In what great war was England engaged 1793-1802? What induced this country to enter into it, and how was it brought to a close?

In the War of the Revolution. Two centuries of despotic rule had wearied the French nation, and as many had acquired the belief that they had a right to freedom, they took the opportunity to rise during the reign of Louis XVI. A revolution took place, amid which many excesses took place, and in this country roused great indignation, although there were found many sympathisers with the revolutionary party. The court party allied themselves with Austria and Prussia, and the result was a declaration of war. Louis was taken prisoner, condemned, and executed. The Republican Government of France now offered their help to English Republicans, and declared war against this country and Holland. Lord Hood took Corsica, Howe defeated the fleet off Ushant, the battle of the Nile was won by Nelson, a rebellion took place in Ireland, ending with the battle of Vinegar Hill and the union of Great Britain and Ireland; the great victory of Copenhagen took place in 1801, and Napoleon sued for peace, which was ratified (and ended the war) at Amiens in 1802.

4. 'November, 1857. Our forces in India, under the splendid leadership of Grant, Outram, Campbell, and Havelock, are holding their own against Nana Sahib with 50,000 men.' Describe the occasion and the results of the exploits referred to.

A mutiny had broken out in India, at Meerut, on the 10th May, 1857. A similar outbreak also occurred at Lucknow on the 31st. On June 27th a number of Europeans who had fled out of Cawnpore were massacred by Nana Sahib, although he had promised to send them to Allahabad. Havelock had driven Nana Sahib from Cawnpore in July, and with Outram went to relieve Lucknow, but they were hemmed in till relieved by Sir Colin Campbell in November. The march of Havelock and Outram to the relief of Lucknow is one of the most exciting events in the history of the mutiny. After the fall of Bareilly in 1858, the mutiny was quelled, the government of the country taken from the hands of the East India Company, and vested in the Crown.

Teaching.

Write out notes of a lesson on

EARTHQUAKES.

Call to mind, if lesson is to elder scholars, the exciting events recorded in the newspapers respecting Ischia and the south of Spain in 1883 and 1884. Earthquakes the cause.

I. *Definition.*—Shaking, (O.E., quaking) of the earth.

II. *Cause of Earthquakes.*—The result of an explosive generated in a small area, but extending itself through cavities in the interior of the earth. Whether this explosion is that of gas or water or both is not ascertained. The connection of volcanoes and earthquakes is clear from many instances on record.

III. *Kinds of Earthquakes.*—Three: undulatory, perpendicular, and horizontal. First, the most common and destructive, the earth moving as the waves of the sea; in the second, the earth is just upheaved and sinks again; the third, of a mixed character.

IV. *Region of Earthquakes.*—In neighbourhood of volcanoes, along well-defined lines. Passing along the whole western side of America, through Japan and Kurile Isles, Further India, across Asia, to Southern Europe.

V. *Results of Earthquakes.*—Very destructive to life and property. Islands destroyed or formed; mountains sink into the earth; great waves formed; men and animals made afraid.

Give instances of famous earthquakes:—

Lisbon, 1775 A.D. (60,000 people killed); Syria, A.D. 17 (120,000); another same country (50,000); Messina, 1692 A.D. (74,000); Mendoza (60,000).

Music.

OLD NOTATION.

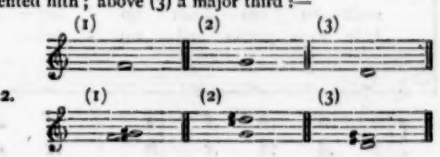
A quarter of an hour allowed for this paper.

(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

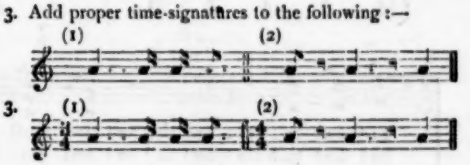
1. Write in the treble clef the signature and the ascending scale of D minor, using the minor or flat sixth and the major or sharp seventh.

1.

2. Write above (1) an augmented second; above (2) an augmented fifth; above (3) a major third:—



3. Add proper time-signatures to the following:—



TONIC SOL-FA NOTATION.

1. Write (1) above *fah* an augmented second; (2) above *soh* an augmented fifth; (3) above *ray* a major third.

1. (1) *se*; (2) *re*'; (3) *fe*.

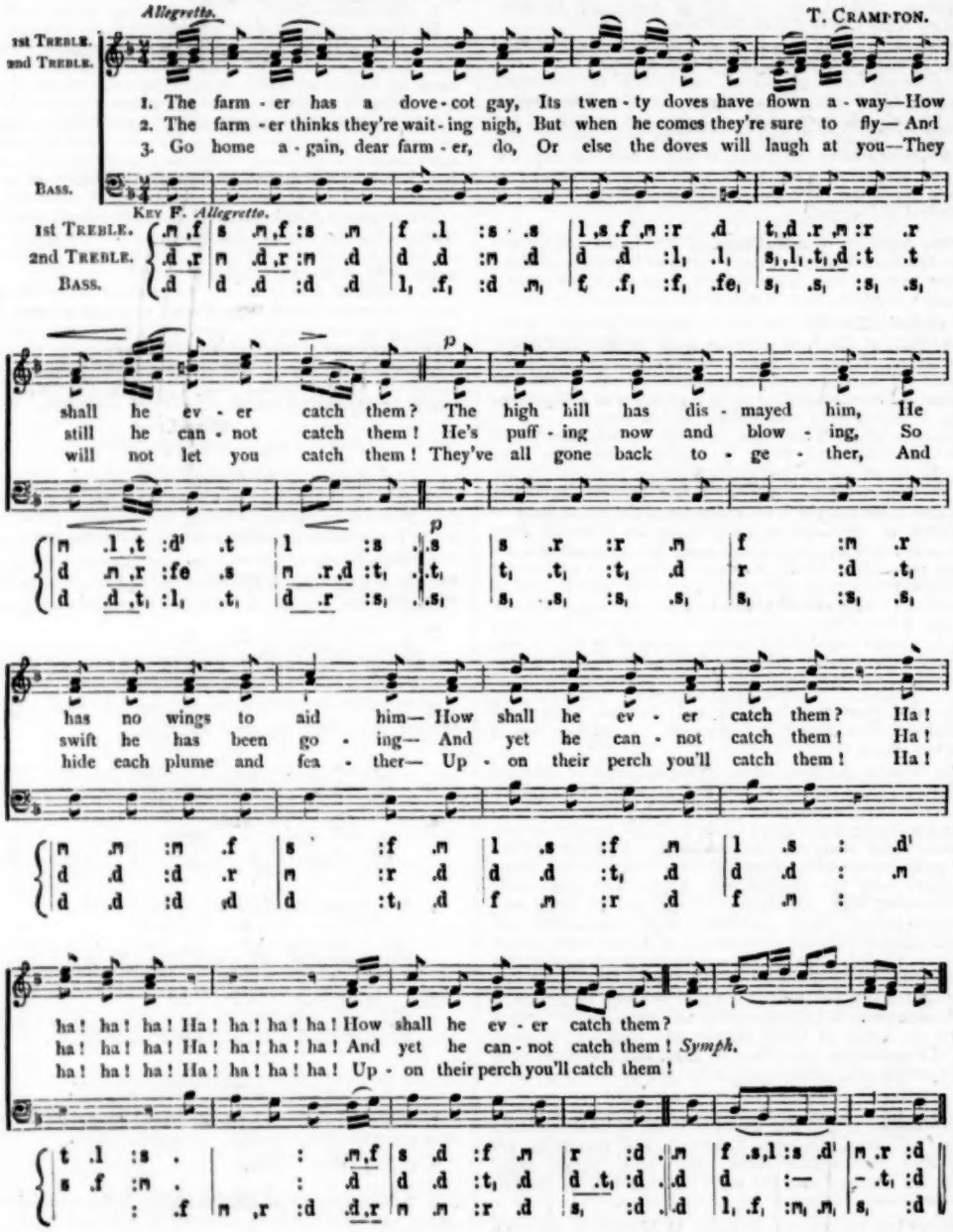
2. In the minor or *lah* mode (1) which is the essential or minor sixth; and (2) which is the essential or major seventh?

2. (1) *fah*; (2) *se*.

3. Write the following in six-pulse measure by trebling the value of every note:—

3. |s ,m ,l :s ,d ,- |m ,- ,r :d ‖

|s :m :l |s :d :- |m :- :r |d :- :- ‖

THE FARMER AND THE PIGEONS.

Allegretto.
T. CRAMPTON.
1st TREBLE.
2nd TREBLE.
BASS.
1. The farm - er has a dove - cot gay, Its twen - ty doves have flown a - way—How
2. The farm - er thinks they're wait - ing nigh, But when he comes they're sure to fly— And
3. Go home a - gain, dear farm - er, do, Or else the doves will laugh at you—They
KEY F. Allegretto.
shall he ev - er catch them? The high hill has dis - mayed him, He
still he can - not catch them! He's puff - ing now and blow - ing, So
will not let you catch them! They've all gone back to - ge - ther, And
has no wings to aid him— How shall he ev - er catch them? Ha!
swift he has been go - ing— And yet he can - not catch them! Ha!
hide each plume and fea - ther— Up - on their perch you'll catch them! Ha!
ha! ha! ha! Ha! ha! ha! ha! How shall he ev - er catch them?
ha! ha! ha! Ha! ha! ha! ha! And yet he can - not catch them! Symph.
ha! ha! ha! Ha! ha! ha! ha! Up - on their perch you'll catch them!

The Practical Teacher.

A MONTHLY EDUCATIONAL JOURNAL.

To Subscribers.—The *Practical Teacher* is published on the 25th of every month. Price 6d.; post free, 7½d.; sent post free, three months for 1s. 11d.; six months, 3s. 9d. a year, 7s. 6d.

P. O. Orders should be made payable at Chief Office.

Subscribers not receiving their copies regularly are respectfully requested to write to the Publisher.

It would save time and expense if subscribers when remitting would state exactly what numbers they wish to be sent.

To Correspondents.—All literary communications should be addressed, THE EDITOR OF THE PRACTICAL TEACHER, Pilgrim Street, Ludgate Hill, London, E. C.

Accepted contributions are paid for within twenty-one days of publication.

The Editor cannot return rejected MSS.; authors should therefore retain copies.

TO ADVERTISERS.

Approved, *prepaid*, advertisements will be inserted in the *Practical Teacher* at the following rates:—

	s.	d.
20 words or under	3	0
Above 20 words and under 32 words ...	4	0
32 words and under 64 words	5	0
For every additional 10 words	1	0

Teachers Advertising for Situations.

	s.	d.
20 words or under	1	0
For every additional 10 words	0	6

For an ordinary page	4 guineas.
For page facing matter	5 guineas.
For 2nd page of wrapper	5 guineas.
For 3rd page of wrapper	5 guineas.
For the page opposite the 3rd page of wrapper	5 guineas.
For the 4th (back) page of wrapper ...	6 guineas.

Parts of a page are charged at a slightly higher rate.—Special quotations will be given for a series.

Portfolios, fitted with elastic bands, for preserving twelve numbers of 'The Practical Teacher,' may now be had. Price 2s. 6d. Orders should be given through booksellers.

Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

Arithmetic.

STANDARD I.

(A).

	307	
346	39	
237	268	
407		
212	427	
364	398	
1566	29	

(B).

		306
416		48
721		258
435		
867		836
932		787
3371		49

STANDARD II.

(A).

406		
3800		
96		76934
5419		804
8		307736
20009		6154720
29738		61854936
30029		
9084		9)70587
20945		7843

(B).

		63074
		95
40302		315370
17219		567666
23083		5992030
96214		
209		
865926		
1924280		11)67241
20108726		6112+9

STANDARD III.

(1) Add together six thousand pounds, four hundred and nineteen pounds sixteen shillings and sevenpence halfpenny, seventeen pounds five shillings and three-farthings, four hundred and sixteen pounds ten shillings and threepence halfpenny, seventeen pounds.

£	s.	d.	
6000	0	0	
419	16	7½	
17	5	0¾	
416	10	3½	
17	0	0	
6870	11	11¾	Ans.

(2) 77)7493400(97316$\frac{68}{77}$ Ans.

693
563
539
244
231
130
77
530
462
68

(3)

£	s.	d.	
600	0	0	
306	4	2	
293	15	10	Ans.

(4) A man had £4732 17s. 2½d.; he distributed amongst poor people £917 13s. 9½d. How much had he left?

£	s.	d.	
4732	17	2½	
917	13	9½	
3815	3	5	Ans.

STANDARD III. (BOYS).

(1) Divide 747630 by 87.

87)747630(8593$\frac{39}{87}$. Ans.
696
516
435
813
783
300
261
39

(2)

£	s.	d.
4	2	9¾
71427	13	9½
9785	4	6
70219	12	11¾
107	14	9½
7217	19	0¾
158762	7	11 Ans.

(3)

£	s.	d.
37231	4	9¾
9304	6	10½
27926	17	11¼ Ans.

(4) The Norman Conquest took place in the year 1066. Queen Victoria began to reign in 1837. Seventy-seven years before this George III. began to reign. How many years after the Conquest was it when George III. began to reign?

George III. began to reign 1837
− 77
1760
Conquest in 1066
Years 694 Ans.

STANDARD III. (GIRLS).

(1) Divide 222176 by 53.

53)222176(4192. Ans.
212
101
53
487
477
106
106

(2) Add:—

£	s.	d.
41963	7	2¼
3847	11	4¾
815	14	6
7138	2	5¼
53764	15	6½ Ans.

(3)

£	s.	d.
4132	17	2¼
917	13	9½
3215	3	5 Ans.

4. A pudding, consisting of flour, currants, raisins, and spice, cost 5s. 4d. The flour cost 2s. 5½d.; raisins, 1½d., and spice 2¼d. How much did the currants cost?

Total cost 5s. 4d.

Flour	2	5½	
Raisins	0	1½	
Spice	0	2¼	
	2	9½	
Currants cost	2	6½	

STANDARD III. (BOYS).

A man bought 625 cattle. One fifth of them were cows, and the rest sheep. How many sheep were there?

5)625 cattle
125 cows
625 cattle
125 cows
500 sheep Ans.

STANDARD IV.

(*Card A.*)

(1) If a draper bought 12 pieces of cloth, each containing 50 yards, at 4½d. per yard, how much would one piece cost?

d.
4½ × 50
10
3 9
5
18 9 Ans.

(2) Divide £19 19s. 11½d. by six times 3s. 10¼d.

s.	d.
3	10¼
	6
23	1½
	12
277	
	2
555	

£	s.	d.
19	19	11½
		20
399		
		12
4799		
		2

)9599(17$\frac{164}{555}$. Ans.
555
4049
3885
164

(3) Multiply £60 9s. 11¼d. by 83

£	s.	d.	
60	9	11¼	× 3
		10	
604	19	4½	
		8	
4839	15	0	
181	9	9¾	
5021	4	9¾. Ans.	

(4) Reduce 76 cwt. 8 lbs. 13 ozs. 8 drs. to drs.

cwt.	lbs.	oz.	drs.
76	8	13	8
112			
160			
836			
8520			
16			
136333			
16			
2181336 Ans.			

(*Card B.*)

(1) If eight persons consumed 120 lbs. of bread in 30 days, how many ounces would each person eat per day? 120 lbs. ÷ 30 = 4 lbs. per day.

4 lbs. for eight persons

= ½ lb. for one person

= 8 ozs. Ans.

(2) Divide £396 12s. 9½d. by 132.

£	s.	d.	£	s.	d.
132)396	12	9½	(3	0	$1\frac{0}{4}\ \frac{85}{132}$. Ans.
396					
0					
20					
132)12(0					
12					
132)153(1					
132					
21					
4					
132)85(0					

(3) Multiply £549 0s. 4½d. by 123.

10 × 12 + 3 = 123.

£	s.	d.	
549	0	4½	× 3
		10	
5490	3	9	
		12	
65882	5	0	
1647	1	1½	
67529	6	1½	Ans.

(4) Reduce 74 yrs. 4 mths. 6 wks. 4 mins. to minutes (13 mths. to yr.).

yrs.	m.	wk.	min.
74	4	6	4
13			
966 mths.			
4			
3870 wks.			
7			
27090 days.			
24			
108360			
54180			
650160 hrs.			
60			
39009604 mins. Ans.			

Geography.

STANDARD III.

(Map of England before the class.)

(1) What is this the map of?—England.

(2) Is England a large country?—No.

(3) How long is England?—From Berwick to Lizard Point it is 420 miles.

(4) What county is this (pointing to Lancashire)?—Lancashire.

(5) What river is this?—Ribble.

(6) What river is this?—Mersey.

(7) What do the people of Lancashire do to get a living?—Work in cotton factories.

(8) Where are cotton goods manufactured?—In Lancashire, at Manchester, Oldham, Bolton, Preston, Chorley, Accrington, Burnley, Wigan, Ashton. In Cheshire at Stockport. In Derbyshire at Glossop

(9) Where do we get cotton from?—Raw cotton comes from the United States, India, and Egypt.

(10) How is it we cannot grow cotton in England?—It is not hot enough.

(11) What is the chief port of Lancashire?—Liverpool.

(12) On what river is it?—The Mersey.

(13) What is this town (pointing to Birkenhead)?—Birkenhead.

(14) In what county is it?—In Cheshire.

(15) Name some other towns on the coast of Lancashire?—Southport, Blackpool, Lytham, Fleetwood, Barrow, Preston.

(16) What town is this (pointing to Fleetwood)?—Fleetwood.

(17) At the mouth of what river is Fleetwood?—Wyre.

(18) What county is this (pointing to Staffordshire)?—Staffordshire.

(19) What do the people do in Staffordshire?—They work in the Potteries, and in the coal and iron mines and iron works.

(20) Where is earthenware made?—In the north.

(21) Where are iron goods made?—In the south.

(22) What is that part of the country called where iron goods are made?—The Black Country.

(23) Name the towns noted for earthenware?—Stoke, Hanley, Burslem, Longton.

(24) Name the towns noted for iron goods.—Wolverhampton, Bilston, Wednesbury, West Bromwich, Tipton, and Oldbury.

(25) Where are woollen goods manufactured?—In the West Riding of Yorkshire.

(26) Where besides Yorkshire?—In Trowbridge and Bradford, in Wiltshire; in Frome, in Somerset; and in Stroud, in Gloucestershire.

(27) Where is lace manufactured?—In Nottingham.

(28) Where are ribbons manufactured?—At Coventry, London, and Manchester.

(29) Where are carpets made?—At Kidderminster and Axminster.

(30) Is there any town in Lancashire where carpets are made?—Yes.

(31) What is it?—Rochdale.

(32) If you wanted a hundredweight of nails, where would you send for it?—To Dudley.

(33) What town not far from Accrington is noted for cotton goods?—Burnley.

(34) How is it proposed to get goods from Liverpool to Manchester?—By a ship canal.

STANDARDS IV., V., AND VI.

(1) What is the largest river in Canada?—The St. Lawrence.

(2) What two lakes are the Niagara Falls between?—Between Erie and Ontario.

(3) What river of Canada runs into the Arctic Ocean?—The River Mackenzie.

(4) What river runs into the Pacific Ocean?—The Frazer River.

(5) What is that part of the country called where the River Frazer is?—British Columbia.

(6) Name a large bay of Canada?—Hudson Bay.

(7) What river runs into it?—The Nelson (one boy). The Churchill (another boy).

(8) What is the capital of Nova Scotia?—Halifax.

(9) What is the capital of Newfoundland?—St. John's.

Query Column.

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents, who send questions for solution, would give (if possible) the required answer, and the source from which the question is obtained.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. ☞ When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

*** All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher, Pilgrim Street, Ludgate Hill, London, E.C.*

Arithmetic.

1. P. M. R.—A man has whisky worth 16s. a gallon, and another lot worth 19s. a gallon; how must he mix these with water to make a mixture of 51 gallons worth 12s. a gallon? (*Hamblin Smith.*)

Difference between price of mixture and 1st kind = 16s. − 12s.
= 4s.;
" " " " " 2nd " = 19s. − 12s.
= 7s.;

∴ a mixture worth 12s. is obtained by mixing $\frac{4}{7}$ or 3 gals. of the 1st kind with 1 gal. of water, or by mixing $\frac{4}{7}$ gals. of the 2nd kind with 1 gal. of water, *i.e.*, 12 gals. of the 2nd kind with 7 gals. of water.

If there are 12 gals. of 2nd kind,

Quantity of 1st kind = {(12s. × 51) − (19s. × 12)} ÷ 16s.
= (612s. − 228s.) ÷ 16s.
= 384s. ÷ 16s.
= 24 gals.;

Quantity of water = 51 gals. − (24 gals. + 12 gals.)
= 15 gals.;

∴ Quantity of 1st kind = 24 gals.
" " 2nd " = 12 "
" " water = 15 "
} Ans.

2. TEACHER.—800 yards of cloth are bought at 10s. 6d. per yard; half is sold at 10s. per yard, and $\frac{1}{5}$ at 11s.; at what price must the remainder be sold at to gain 5½ per cent. on the whole?

Cost of cloth = 10s. 6d. × 800
= £420;

Selling price of the whole = $£420 \times \frac{105\frac{1}{2}}{100}$
= $£420 \times \frac{211}{200}$
= $£\frac{21 \times 211}{10}$
= £443 2s.;

Selling price of one-half = 10s. × 400
= £200;
" " " one-fifth = 11s. × 160
= £88;

∴ Remainder must be sold for
£443 2s. − (£200 + £88)
= £155 2s.;

∴ Selling price per yard of the remainder
= £155 2s. ÷ 240
= 12s. 11$\frac{1}{10}$d. Ans.

Note.—(1) For every pound the difference = 3d.;

d.	£ s.	£
3	3 10	1

∴ 3 : 3 10 :: 1 : Rent.

(2) The solution of your third query appeared in our issue for July, 1884.

3. SHON SYCHPANT.—Part of a sum of £3000 is invested to produce 3½ per cent. per annum, and the remainder 4½ per cent.; if the interest on the whole for a year amounts to £122 9s. 10½d., find the sum invested at each rate. (*Scholarship*, 1880.)

Interest on £3000 at 4½ per cent. = £135;
Difference between this interest and the interest received
= £135 − £122 9s. 10½d.
= £12 10s. 1½d.;

Difference between the interest on £100 at 4½ and 3½ per cent. respectively = £1;

∴ Sum invested at 3½ per cent.
= £12 10s. 1½d. × 100
= £1250 10s.;

Sum invested at 4½ per cent.
= £3000 − £1250 10s.
= £1749 10s.

Note.—No. They are the actual answers given by Mr. D'Albertanson.

4. SELF-TAUGHT.—A person sells out of Consols at 92⅛, and buys Exchequer bills at 7s. 6d. premium, when the interest is 2½d. per day. How is his income affected?

(Consols are at 3 per cent.)

Income for an investment of £92⅛ in 1st case = £3;

£	£		d.	
100⅜	92⅛	::	($\frac{368}{4}$ × 2½)	: Income in 2nd case.
8	8		5	
803	737			
73	67			

= (335 × 2½)d.
= 837½d.
= £3 9s. 9½d.

∴ Annual increase for an investment of £92⅛
= £3 9s. 9½d. − £3
= 9s. 9½d.

General.

1. RALPH.—The diagonals of a parallelogram make an angle of 35° with one another, and are severally 117·72 and 157·41 feet long. What is the area of the parallelogram? (*Science and Art*, May, 1882.)

Area of parallelogram
= 4 times area of triangle with sides $\frac{117{\cdot}72}{2}$ ft.
and $\frac{157{\cdot}42}{2}$ ft. and included angle 35°
= {4 × ($\frac{1}{2}$ × 58·86 × 78·705 × sin 35°)} sq. ft.
= (58·86 × 157·41 × ·5735764) sq. ft.
= 5,314·27287375864 sq. ft. Ans.

2. UNITY.—(*a*) Yes. (*b*) Yes. (*c*) £50.

3. RIVINGTON PIKE.—Thanks for your communication. In the Euclid paper of the 3rd year in our Prize Competition, the proposition in the first question is the 27th and not the 29th, and in the second question is the 46th and not the 48th.

4. STUDENT.—(*a*) Refer to the solution in our issue of January, 1885. (*b*) The solution of your second query appeared in our issue for November, 1884. The answer is 94⅞.

5. INQUISITIVE.—The solution of your query appeared in our issue for February, 1885.

6. PERPLEXED.—Consult *Deschanel's* 'Natural Philosophy,' Part I. (Blackie and Son), or 'Weather Forecasts by the Clerk.'

7. EXCELSIOR.—Any book on physical geography would suit your purpose. You are doubtless aware that *Huxley's* 'Physiography' is an excellent book. The handbook of the English

language by Dr. Angus, and the companion volume on English literature are very good, but most likely too voluminous. Try *Dr. Smith's* 'English Grammar' by Murray, 3s. 6d.

8. BILL AND WILLIE.—You should have told us what you can do in mathematics, and what purpose you have in view. Perhaps we shall be safe in recommending you 'Mechanics for Beginners' by *Todhunter* (Macmillan).

9. ETUDIANT.—Yes. Write to the secretary and get a copy of the syllabus, where you will find all the information you want.

10. C. EXAMINATION.—'La Jeune Siberienne' and 'Le Cid' are both published by Hachette and Co. The editions are cheap and contain English notes.

11. SUBSCRIBER.—(1) No. (2) Most likely, if application be made.

12. CORNARD.—Try *Macmillan's* 'Progressive Course,' Part I., or *Cassell's* 'Lessons in French' reprinted from the 'Popular Educator.'

13. ALCIBIADES.—For Vergil, read *Connington's* translation, for Homer, read *Butcher's* translation. *Professor Church's* 'Stories from Vergil and Homer' might suit you. A classical dictionary of Mythology would be almost necessary. *Dr. Smith's* is 18s. (Murray). There is a cheap edition at 3s. 6d. which would perhaps be enough. (See review on page 188.)

14. J. J. HOMER.—A cubic metre contains 1000 litres. 1000 litres at 50°C. and pressure 50 cms. would become at 0°C. and pressure 76 cms.

$$\frac{1000\times 50\times 273}{76\times 323}\text{ litres,}$$

and ∴ the mass would be

$$\frac{1000\times 50\times 273\times 1{\cdot}293}{76\times 323}$$
$$=718{\cdot}977\text{ gms.}$$

15. VYKING.—(1) Add *Belcher's* 'Latin Composition' (Macmillan): cheap and good. (2) We think not.

16. UNLUCKY.—(1) We think about 60. (2) Yes. (3) Penmanship. The word 'Penmanship' would be worth 40. The letters were wrong, if you meant it for small hand, and much too small for large hand. Get some good copies and practise.

17. ELEANOR.—Large hand, 40; small, 65.

18. LOT.—Large hand, 50; small hand 70.

19. TRUE PATRIOT.—(1) Possibly. You must do excellently in the subjects you do take. (2) None specially. (3) Large hand, 75; small hand, 90.

20. SURVEYOR.—A Gunter's chain would cost about 9s. in iron, and 16s. in steel. We cannot tell you the cost of other instruments till you say which you mean.

You appear to need no more than accurate drawing to scale. Read the lessons on drawing to scale now passing through the PRACTICAL TEACHER. Land-surveying and Mathematical Instruments in *Weale's* 'Series' will be what you want. Your writing needs attention, and your composition is very bad indeed.

21. ATTENTION.—Yes. It will be necessary.

22. PUZZLED.—The gain on 21s. selling price was the same as the gain on 18s. 6d. buying price. The gain on the buying price is 2s. 6d. on 18s. 6d. Therefore, gain on £1,000 buying price is

$$\frac{1000\times 2\text{s. }6\text{d.}}{18\text{s. }6\text{d.}}=\frac{1000\times 40}{37\times 8}=\frac{5000}{37}=£135\text{ 2s. }8\text{d.}$$

23. FAIRPLAY.—The large hand, 50; the small, 70.

24. S. JONES.—Large hand, 65; small, 80.

25. J. H. LUCAS.—You have no claim. It is a matter of arrangement. You are not entitled to any part of the grant unless it has been agreed that you are to have it. Whether you should not ask for such an arrangement as you desire is another question.

26. MOZART.—You do not say at what university you wish to be examined. The professor of music at Cambridge would no doubt give you particulars. You could also write to the registrar of the London University, Burlington House, W., for a syllabus, which is sent free.

27. ANXIOUS.—Large hand, which should slope more, 90; small hand, 95. Large hand, 60; small hand, 85.

28. GLYNDWR.—Small hand, 80; large hand, 85. Our remarks apply specially to the first essay. You need to study spelling. Each sentence should end with a full stop. You have not put one in the whole of the essay. You end your sentences thus — or ,— Write easy sentences, using none but plain and simple words, and, remember, the elements of composition are not so much words as phrases.

You are not at liberty to put words together in any order you like. We do not say, 'Criticise upon a piece;' dominions dont accede; nor do we 'excite' the establishment of colonies.

You would do well to buy and study 'Lessons in English,' by Seeley and Abbott, especially the chapter on diction.

Read the rules of the Query Column.

29. S. JONES.—We received no specimens of your writing. If you mean the letter to be valued, we should say 60.

30. A. DENBIGH.—If the results have arrived, you will state what they are; if they have not, state in what subject you have been examined, leaving the results to be filled in at the office. Large hand, 60; small, 85.

31. ANGLESEA.—The ratio of the diameter to the circumference of a circle is given in the books as 113 : 355.

$$\frac{355}{113}=3{\cdot}14159\ldots$$

32. LIONEL CLARENCE.—The solution of your query appeared in our issue for April, 1885.

33. SUBSCRIBER.—(1) The equality of the opposite angles of a parallelogram is proved in Prop. 34, Book I. (2) *Egan's* 'Exercises in Euclid,' Parts 1 and 2. (3) *Gill's* 'School Management'; 'Manual of Method,' by *A. Parkes; Gladman's* 'School Method.'

34. G. J. HOWELL.—If you will kindly repeat your query, we shall be glad to let you have a reply.

35. X. Y. Z.—If a and b represent the lengths of two given right lines, find, by a geometrical construction, the line whose length is represented by $\frac{a^3}{b^2}$. (*University of London, B.A. Examination*, 1884.)

We shall write $\frac{a^3}{b^2}=\frac{a}{b}\times\frac{a^2}{b}$ and the proof will divide into two stages. I. To find the line which is equal to $\frac{a^2}{b}$. II. To find the line which is $\frac{a}{b}\times$ the line found in I.

I. If $\frac{a^2}{b}=c$, $a^2=bc$, *i.e.*, $b:a::a:c$, whence it is clear that the line c, whose length is required, is a third proportional to the lines b and a, and its value is ∴ to be found by Euclid, Book VI., Prop. 11.

II. We have now found c geometrically, and all that remains is to find geometrically $\frac{a}{b}\times c$. But if this is equal to d, $ac=bd$, *i.e.*, $b:a::c:d$ ∴ d is the fourth proportional to the three known lines, b, a, and c, and its value can be found by Euclid VI., 12. But d is the line required.

N.B.—For this particular question a method might have been easily obtained in solid geometry, but the method above given has the advantage of being equally applicable to geometrically representing such expressions as $\frac{a^4}{b^3}$, $\frac{a^4}{b^2c}$, $\frac{a^4}{bcd}$, etc., etc.; where a, b, c, d are known lines.

36. SOLICITOR.—The volume of a ring is the product of the circular section by the length. The length is the length of the circumference of the circle which passes through the centre of all the cross sections of the ring, or half the sum of the inner and outer boundaries of the ring. (*Todhunter's* 'Mensuration for Beginners,' page 147.) The data you give seems to be insufficient.

If n be the number of links, d the internal diameter of each link, and c the diameter of the cross section of the rope or of a link.

Then the length of n links will be $dn+2c$.

The volume of a link is $\left(\frac{c^2}{4}\times\pi\right)\left(c+d\right)\pi$.

∴ The volume of n links is $\pi^2n\frac{c^2}{4}(c+d)$.

Now the volume of the same length of the rope is

$$=\text{length}\times\text{area of cross section}$$
$$=(dn+2c)\frac{c^2}{4}\times\pi.$$

∴ The weight of chain : weight of equal length of rope

$$:: \pi^2 n^2 \frac{c^2}{4}(c+d) \; : \; \pi^2 \frac{c^2}{4}(dn+2c)$$

$$:: \frac{n\pi}{4}(c+d) \; : \; (dn+2c).$$

37. ISSE.—*Gill's* method is supposed to be the best. For details see *Findlater's* 'Physiography,' or better, The Volume on the Sun, International Series, by *Young*.

38. ——— 'Thereof' may be parsed as 'of that.' 'There' is from the old dative feminine singular of the demonstrative adjective. 'Whereby' may be parsed as 'by which.' It is from the old dative feminine singular of the relative. Such words are often classed as adverbs; see Daniel's English Language (National Society), page 112.

39. KHOKAN—
when—conjunction.
that—conjunction, introducing the sentence, 'One talent is lodged with me useless.'
one—definite numeral adjective, qualifying 'talent.'
to hide—verb, infinitive mood, used as noun and subject to 'is,' and governing 'which' in obj. case.
lodged—past participle ('is' is understood).
is lodged—verb, trans., indic. mood, present tense, passive voice, third singular, agreeing with talent.
useless—adj., qualifying 'talent.' (See 38.)
therewith—instrumental adverb, or parse as 'with which.'
lest—conjunction of purpose.
returning—present participle, qualifying 'he.'
light—noun com., neuter, nom. absolute, 'being' understood.
who—rel. pro, referring to antecedent *they*, nom. plural to 'bear.
best—adverb, qualifying *serve*.

Algebra.

1. GENTIL.—Find the Highest Common Factor of $7x^4+6x^3-8x^2-6x+1$ and $11x^4+15x^3-2x^2-5x+1$.

$$\begin{array}{r} 11x^4+15x^3-2x^2-5x+1 \\ \hline 7 \\ 7x^4+6x^3-8x^2-6x+1)\overline{77x^4+105x^3-14x^2-35x+7}(11 \\ 77x^4+66x^3-88x^2-66x+11 \\ \hline 39x^3+74x^2+31x-4 \end{array}$$

$$\begin{array}{r} 7x^4+6x^3-8x^2-6x+1 \\ \hline 39 \\ 39x^3+74x^2+31x-4)\overline{273x^4+234x^3-312x^2-234x+39}(7x \\ 273x^4+518x^3+217x^2-28x \\ \hline -284x^3-529x^2-206x+39 \\ -39 \\ \hline 11076x^3+20631x^2+8034x-1521(284 \\ 11076x^3+21016x^2+8804x-1136 \\ \hline -385)-385x^2-770x-385 \\ x^2+2x+1 \end{array}$$

$$\begin{array}{r} x^2+2x+1)39x^3+74x^2+31x-4(39x-4 \\ 39x^3+78x^2+39x \\ \hline -4x^2-8x-4 \\ -4x^2-8x-4 \end{array}$$

∴ G. C. M. $= x^2+2x+1$.

2. GUILLAUME.—A man puts out £2000 in two investments. For the first he gets 5 per cent., for the second 4 per cent. on the sum invested, and by the first investment he has an income of £10 more than on the second. Find how much he invests in each. (*Hamblin Smith.*)

Let x = amount of first investment in pounds,

Then, $2000-x$ = " second " ";

$$\therefore \frac{x}{20}-\frac{2000-x}{25}=10$$

$$5x-8000+4x=1000$$

$$9x=1000+8000$$

$$=9000$$

$$\therefore x=1000.$$

∴ Amount of each investment = £1000.

3. CYCLOPS.—Find the number of the combinations of the letters in the word *proportion* taken 6 at a time. (*Todhunter.*)

(*a*) There is 1 case in which no letter is repeated.

(*b*) There are 5 cases in which p occurs twice, as many in which r occurs twice, and as many in which o occurs twice; 15 in all.

$$\left(\frac{5\cdot 4\cdot 3\cdot 2}{\lfloor 4}=5\right)$$

(*c*) There are 10 cases in which o occurs 3 times.

$$\left(\frac{5\cdot 4\cdot 3}{\lfloor 3}=10\right)$$

(*d*) There are 6 cases in which p and r each occur twice, as many in which p and o each occur twice, and as many in which r and o each occur twice; 18 in all.

$$\left(\frac{4\cdot 3}{\lfloor 2}=6\right)$$

(*e*) There are 4 cases in which o occurs three times and p twice, and as many in which o occurs three times and r twice; 8 in all.

(*f*) There is 1 case in which p occurs twice, r twice, and o twice.

∴ No. of combinations $= 1+15+10+18+8+1$
$= 53$. Ans.

4. ESSAVIST.—A point moves with a speed which is different in different miles, but invariable in the same mile, and its speed in any mile varies inversely as the number of miles travelled before it commences this mile. If the second mile be described in two hours, find the time occupied in describing the n^{th} mile.

The *speed* in the n^{th} mile varies inversely as $n-1$, and therefore the *time* of describing the n^{th} mile varies directly as $n-1$.

Denote this time in hours by $m(n-1)$.

Since the second mile is described in two hours we have

$$2=m(2-1),$$

$$\therefore m=2.$$

∴ Time of describing the n^{th} mile $= 2(n-1)$.

5. CHUZZLEWIT.—Suppose y varies as a quantity which is the sum of three quantities, the first of which is constant, the second varies as x, and the third as x^2. And suppose that when $x=a$, $y=0$; when $x=2a$, $y=a$; and when $x=3a$, $y=4a$. Show that when $x=na$, $y=(n-1)^2a$.

Denote the first quantity by p, the second by qx, and the third by rx^2;

Then, y varies as $p+qx+rx^2$.

Put $y=m(p+qx+rx^2)$,

Then $0=m(p+qa+ra^2)$, (1)

$a=m(p+2qa+4ra^2)$, (2)

$4a=m(p+3qa+9ra^2)$; (3)

$$\left.\begin{array}{l} (1)\ mp+\ mqa+\ mra^2=0 \\ (2)\ mp+2mqa+4mra^2=a \end{array}\right\}$$

$$mqa+3mra^2=a \quad (4)$$

$$\left.\begin{array}{l} 3mqa+9mra^2=3a \\ (3)\ mp+3mqa+9mra^2=4a \end{array}\right\}$$

$$\therefore mp=a.$$

$$\left.\begin{array}{l} (3)\ mp+3mqa+9mra^2=4a \\ (1)\ mp+\ mqa+mra^2=0 \end{array}\right\}$$

$$\left.\begin{array}{l} 2mqa+8mra^2=4a \\ mqa+4mra^2=2a \\ (4)\quad mqa+3mra^2=a \end{array}\right\}$$

$$mra^2=a$$

$$mra=1$$

$$\therefore mr=\frac{1}{a}.$$

(1) $mp+mqa+mra^2=0$

$$a+mqa+a=0$$

$$mqa=-2a$$

$$\therefore mq=-2$$

Thus,

$$y=a-2x+\frac{x^2}{a}$$

$$=a\left(1-\frac{2x}{a}+\frac{x^2}{a^2}\right)$$

$$=a\left(\frac{x^2}{a}-\frac{2x}{a}+1\right)$$

$$=a\left(\frac{x}{a}-1\right)^2$$

$$\left(\text{But } x=na, \therefore \frac{x}{a}=n.\right)$$

$$\therefore y=a(n-1)^2.$$

6. BLACKBIRD.—Assuming that the quantity of work done varies as the cube root of the number of agents, when the time is the same, and varies as the square root of the time, when

the number of agents is the same, find how long 3 men would take to do one-fifth of the work which 24 men can do in 25 hours. (*Todhunter.*)

Let x denote the quantity of work done in y hours by z men;

Then, x varies as $z^{\frac{1}{3}}$, when z alone varies, and varies as $y^{\frac{1}{3}}$, when y alone varies;

$\therefore$ When both y and z vary, x varies as $z^{\frac{1}{3}}y^{\frac{1}{3}}$.

Put $x = mz^{\frac{1}{3}}y^{\frac{1}{3}}$

Put $z=24$, $y=25$, $x=1$;

$\therefore 1 = m\ (24)^{\frac{1}{3}}\ (25)^{\frac{1}{3}}$,

$\therefore m = \dfrac{1}{5(24)^{\frac{1}{3}}}$;

So that $x = \frac{1}{5} \cdot \left(\dfrac{z}{24}\right)^{\frac{1}{3}} \cdot y^{\frac{1}{3}}$.

Now put $z=3$, $x=\frac{1}{5}$, and find y.

$\therefore \frac{1}{5} = \frac{1}{5} \cdot \left(\dfrac{3}{24}\right)^{\frac{1}{3}} \cdot y^{\frac{1}{3}}$

$1 = (\frac{1}{2})^{\frac{1}{3}} \cdot y^{\frac{1}{3}}$

$= \frac{1}{2}y^{\frac{1}{3}}$

$y^{\frac{1}{3}} = 2$

$\therefore \underline{y=4}$.

$\therefore \underline{\text{Time} = 4 \text{ hours.}}$ Ans.

7. MILLIE.—A man borrows £100 at 5 per cent. compound interest, to be repaid by 25 equal yearly instalments. Find the annual payment.

Let A denote an annual payment in pounds, n the number of years, R the amount of one pound in one year, and P the amount of the loan in pounds.

Then, $PR^n = \dfrac{R^n - 1}{R-1}A$;

$\therefore 100 \times (\frac{21}{20})^{25} = \dfrac{(\frac{21}{20})^{25} - 1}{\frac{21}{20} - 1}A$,

$$\left\{\begin{aligned} \text{Log } (\tfrac{21}{20})^{25} &= (\log 21 - \log 20) \times 25 \\ &= (1{\cdot}3222193 - 1{\cdot}30103) \times 25 \\ &= {\cdot}0211893 \times 25 \\ &= {\cdot}5297325 \\ &= \log 3{\cdot}386354. \end{aligned}\right.$$

$$100 \times 3{\cdot}386354 = \frac{3{\cdot}386354 - 1}{\frac{1}{20}}A,$$

$$= 2{\cdot}386354 \times 20 \times A,$$

$$2{\cdot}386354 \times A = 3{\cdot}386354 \times 5$$

$$= 16{\cdot}93177$$

$$\therefore A = \frac{16{\cdot}93177}{2{\cdot}386354} £$$

$$£$$

$$= 2{\cdot}386354)16{\cdot}9317770(7$$

$$16\ 704478$$

$$227292$$

$$20$$

$$4545840(1s.$$

$$2386354$$

$$2159486$$

$$12$$

$$25913832(10\tfrac{3}{4}d.$$

$$2386354$$

$$2050292$$

$$4$$

$$8201168$$

$$7159062$$

$$1042106$$

$\therefore \underline{\text{Annual payment} = £7\ 1s.\ 11d.}$

8. WILL-O'-TH'-WISP.—Simplify:—

$$\frac{a}{b - \dfrac{c}{d - \dfrac{e}{f}}}$$

$$\frac{a}{b - \dfrac{c}{d - \dfrac{e}{f}}}$$

$$= \frac{a}{b - \dfrac{c}{\dfrac{df-e}{f}}}$$

$$= \frac{a}{b - \dfrac{cf}{df-e}}$$

$$= \frac{a}{\dfrac{bdf - be - cf}{df-e}}$$

$$= \underline{\frac{adf - ae}{bdf - be - cf}}$$ Ans.

9. PUZZLED.—There is a certain fish, the head of which is 9 inches long; the tail is as long as the head and half the back; and the back is as long as the head and tail together; what is the length of the back and of the tail? (*Todhunter's* 'Algebra for Beginners.')

Let x = Length of back in inches,

Then, $\frac{x}{2} + 9 =$ " tail " ;

$\therefore x = 9 + \frac{x}{2} + 9$

$x - \frac{x}{2} = 18$

$\frac{x}{2} = 18$

$\therefore \underline{x = 36}$.

$\therefore$ Length of back = 36 inches;

" " tail = (36 − 9) inches

$= \underline{27 \text{ inches.}}$

Mensuration.

1. J. H. R.—Four ladies purchased a ball of exceeding fine thread, 3 in. in diameter. What portion of the diameter must each wind off, so as to share off the thread equally? ('National Arithmetic,' *Canadian Publication.*)

Similar spheres are to one another as the cubes of their diameters.

$\therefore$ Diameter of 2nd, 3rd, and 4th parts $= \sqrt[3]{3^3 \times \frac{3}{4}}$ in.

$= \sqrt[3]{20{\cdot}25}$ in.

$= 2{\cdot}7256\ldots$in;

$\therefore$ First lady must wind off 3 in. − 2·7256...in.

$= \underline{{\cdot}2743\ldots\text{in.}}$

$\therefore$ Diameter of 3rd and 4th parts $= \sqrt[3]{3^3 \times \frac{1}{4}}$ in.

$= \sqrt[3]{13{\cdot}5}$ in.

$= 2{\cdot}3811\ldots$in.;

$\therefore$ Second lady must wind off

2·7256...in. − 2·3811...in.

$= \underline{{\cdot}3445\ldots\text{in.}}$

$\therefore$ Diameter of 4th part $= \sqrt[3]{3^3 \times \frac{1}{8}}$ in.

$= \sqrt[3]{6{\cdot}75}$ in.

$= 1{\cdot}8898\ldots$in.;

$\therefore$ Fourth lady must wind off $\underline{1{\cdot}8898\ldots\text{in.}}$,

and third " " " " 2·3811...in. − 1·8898.. in.;

$= \underline{{\cdot}4912\ldots\text{in.}}$ Ans.

2. ASSISTANT.—A right cone exactly fits on the top of a right cylinder. If the volume of the whole figure be 8·8 cub. ft., and the volume of the cylinder : volume of cone :: 3 : 2, and the diameter of the cylinder is 2 ft., find the height and area of the surface of the cylinder, also the height of the cone. (*Victoria University Mathematical Paper for B.Sc. Degree.*)

(Put H for height of cylinder in ft., and h for height of cone in ft.)

Then, $(2^2 \times {\cdot}7854 \times \text{H}) + \left(2^2 \times {\cdot}7854 \times \frac{h}{3}\right) = 8{\cdot}8$;

$(2^2 \times {\cdot}7854 \times \text{H}) = \frac{3}{4}\left(2^2 \times {\cdot}7854 \times \frac{h}{3}\right)$,

$\text{H} = \frac{2}{2} \times \frac{h}{2}$

$= \frac{h}{2}$,

$\therefore \underline{h = 2\text{H}}$.

$$(4\times\cdot7854\times H)+\left(4\times\cdot7854\times\frac{2H}{3}\right)=8\cdot8,$$

$$4\times\cdot7854\times\left(H+\frac{2H}{3}\right)=8\cdot8,$$

$$\tfrac{5}{3}H=\frac{2\cdot2}{\cdot7854}$$

$$=\frac{1}{\cdot357}$$

$$\therefore H=\frac{200}{357}\times\frac{7}{8}$$

$$=\frac{119}{119}$$

$$=1\cdot6806\ldots$$

∴ Height of cylinder = 1·6806...ft.

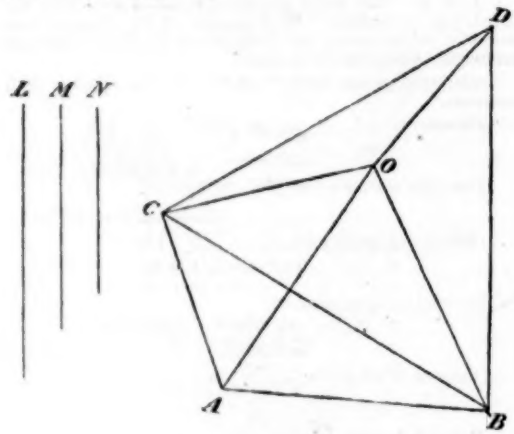
Surface of cylinder $=\left(2\times\frac{22}{7}\times\frac{200}{119}\times\cdot0264\right)$ sq. ft.
$+2(2^2\times\cdot7854)$ sq. ft.
$=(10\cdot56+6\cdot2832)$ sq. ft.
$=16\cdot8432$ sq. ft.

Height of cone $=(\frac{119}{119}\times2)$ ft.
$=\frac{238}{119}$ ft.
$=3\cdot3613\ldots$ ft.

Geometry.

1. A. E. RUST and MISTY.—Show how to construct an equilateral triangle, having given three lines severally equal to the distances from its angular points to a point within it.

State the conditions that must be satisfied by the three given lines in order that the construction may be possible. (*1st Stage Mathematics*, 1884.)



Let L, M, N represent the lengths of the distances from a point within the triangle. Take AB = L, and upon it describe the equilateral triangle AOB; (I. 1.) Upon AO construct the triangle ACO, having its sides equal to AO, M, and N, respectively, so that OC = M, and AC = N; (I. 22.) Join BC, and upon it describe the equilateral triangle BDC.

Then BDC shall be the equilateral triangle required.

Join OD.

Proof.—OB = AB = L, and OC = M;

LCBD = LABO, each being an angle of an equilateral triangle;

Take away the common angle OBC,

Then, LOBD = LABC, (Ax. 3.)

And sides OB, BD = sides AB, BC, each to each;

∴ Base OD = base AC = N. (I. 4.)

Therefore the equilateral triangle BDC is the triangle required.

Note.—As we have to describe a triangle with sides equal to the three given lines, therefore any two of them must be greater than the third.

University of London.

SOME of our readers will be interested in learning the percentage of failure in each of the subjects at the Matriculation Examination last January. In Latin, 15 per cent. failed to pass; in Greek, 20 per cent.; in French, 6 per cent.; in German, 8 per cent.; in mathematics, 19 per cent.; in English, 11 per cent.; in natural philosophy, 17; and in chemistry, 22 per cent. The total number of candidates who presented themselves was 743, of whom 72 were placed in the Honours Division, 330 in the First Division, 49 in the Second Division, and 292 failed.

There were 60 female candidates. Their percentage of failure was less than that of male candidates. On the other hand, they had a smaller percentage in the Honours Division.

We give the passages set last January from books not prescribed, and also translations of them.

LATIN.

Passages for Translation from Books not prescribed.

1. Metellus Numidicus populari factione patria pulsus in Asiam secessit. In qua cum ei forte ludos Trallibus spectanti litterae redditae essent, quibus scriptum erat, maximo senatus et populi consensu reditum illi in urbem datum, non e theatro prius abiit, quam spectaculum ederetur: non laetitiam suam proxime sedentibus ulla ex parte patefecit, sed summum gaudium intra se continuit.

2.

Triste petis munus; quis enim sua proelia victus
Commemorare velit? referam tamen ordine; nec tam
Turpe fuit vinci, quam contendisse decorum est,
Magnaque dat nobis tantus solacia victor.

Translation.

1. Metellus Numidicus, when driven from his country by the popular party, withdrew into Asia. There, as he was one day by chance watching a performance in the theatre at Tralles, a letter was delivered to him signifying that leave to return to Rome had been unanimously granted him by the Senate. Yet he did not leave the theatre till the performance was over, nor showed his delight in any way to those that sat by him, keeping close within his own breast the exceeding joy which he felt.

2. Unpleasing is the boon thou askest; who would wish to make mention of the battles he has lost. Yet will I tell you the story in due order. Nor was it so much dishonour to be conquered as honourable to have contended. And great solace to us is the greatness of our conqueror.

GREEK.

III.—*Passages from Books not prescribed.*

1. Καλῶς δέ μοι δοκεῖ ἔχειν καὶ ἡ τοῦ βαρβάρου λεγομένη ἀπόκρισις, ὅτε βασιλεὺς ἅρα ἵππου ἐπιτυχὼν ἀγαθοῦ παχῦναι αὐτὸν ὡς τάχιστα βουλόμενος ἤρετο τῶν ἐειπῶν τινα ἀμφ' ἵππους δοκούντων εἶναι, τί τάχιστα παχύνει ἵππον· τὸν δ' εἰπεῖν λέγεται, ὅτι δεσπότου ὀφθαλμός.

2. Φιλοῦσι γάρ τοι τῶν μὲν ὀλβίων βροτοὶ σοφοὺς τίθεσθαι τοὺς λόγους, ὅταν δέ τις λεπτῶν ἀπ' οἴκων εὖ λέγῃ πένης ἀνήρ,

γελᾶν· ἐγὼ δὲ πολλάκις σοφωτέρους
πένησταν ἄνδρας εἰσορῶ τῶν πλουσίων,
καὶ θεοῖσι μικρὰ χειρὶ θύοντας τέλη
τῶν βουθυτούντων ὄντας εὐσεβεστέρους.

3. Ἐξέτασον τοίνυν παρ' ἄλληλα τὰ σοὶ κἀμοὶ βεβιωμένα πράως, μὴ πικρῶς· εἶτ' ἐρώτησον τούτους τὴν ποτέρου τύχην ἂν ἕλοιθ' ἕκαστος αὐτῶν.

Translation.

1. That too was, to my mind, a good answer of the Persian in the story. The king, it seems, had acquired a fine horse, and wishing to fatten it as soon as possible, asked one of those who was supposed to be knowing about horseflesh, 'What fattens a horse soonest?' The answer is said to have been, 'The master's eye.'

2. For men are wont to count the words of the rich wise, and to laugh when a poor man of a humble house speaks well. But I observe that poor men often are wiser than the rich, and those who lay slender offerings on the altars of the gods have more piety than those that offer oxen.

3. Set forth then, side by side, the history of your life and of mine, temperately and without bitterness, and then ask our hearers whose lot of the two each of them would choose.

The following passages were set to be translated into Latin :—

10. Translate into Latin—

[N.B.—Great importance is attached to the correct rendering of these sentences.]

(*a*) It is of great interest to your parents that you should be diligent.

(*b*) Cicero is said to have been the most eloquent of all Roman orators.

(*c*) Granting that the cause of the war had been a just one, still the general ought not to have acted as he did without the authority of the senate.

(*d*) I had hoped to see Pompey before he started from Rome.

(*e*) Even if I had known his design to murder his opponent, I could not have prevented him.

(*f*) Although Cæsar was ready to make many concessions, Pompey, trusting to the support of the nobility refused to listen to any proposal of conciliation.

Translations.

(*a*) Magni parentum tuorum interest te diligentem esse.

(*b*) Cicero fertur oratorum Romanorum omnium sapientissimus fuisse.

(*c*) Fac ut causa belli justa fuerit, imperatorem ea quæ ejet agere non oportuit sine senatus auctoritate.

(*d*) Speraveram me Pompeium ante visurum esse quam Roma profectus esset.

(*e*) Etiamsi cum adversarii interficiendi consilium iniisse novissem, prohibere non potiussem.

(*f*) Quanquam Cæsar multa concessurus erat, Pompeius nobilium studiis fretus nullam suo inter se conciliendo rationem audire voluit.

THE EXAMINERS FOR 1885-6.

Classics.—Leonhard Schmitz, Esq., LL.D., Ph.D., F.R.S.E., and Prof. A. S. Wilkins, LL.D., M.A.

The English Language, Literature, and History.—Henry Craik, Esq, LL.D., M.A., and Prof. J. W. Hales, M.A.

The French Language and Literature.—Rev. P. H. E. Brette, B.D., B.A., and Amédée Esclangon, Esq.

The German Language and Literature.—Prof. C. A. Buchheim, Ph.D., and Rev. C. Schoell, Ph.D.

Mental and Moral Science.—Prof. G. Croom Robertson, M.A., and James Ward, Esq., M.A.

Mathematics and Natural Philosophy.—Prof. A. G. Greenhill, M.A., and Prof. M. J. M. Hill, M.A.

Experimental Philosophy.—Prof. G. Carey Foster, B.A., F.R.S., and Prof. A. W. Reinold, M.A., F.R.S.

Chemistry.—Prof. J. Emerson Reynolds, M.D., F.R.S., and Prof. T. E. Thorpe, Ph.D., F.R.S.

Botany and Vegetable Physiology.—Prof. Bayley Balfour, M.D., D.Sc., F.R.S., and Prof. F. O. Bower, B.A.

Comparative Anatomy and Zoology.—Prof. E. Ray Lankester, M.A., F.R.S., and Prof. Alexander Macalister, M.D., M.A., F.R.S.

Geology and Palæontology.—Rev. Prof. T. G. Bonney, D.Sc., F.R.S., and Prof. W. Boyd Dawkins, M.A., F.R.S.

—o—

Publications Received.

Blackie and Son—
Scripture Biography and its Teachings. By Joseph Hassell.
Advanced Studies in Flower Painting. Parts 1 to 6. By Ada Hanbury.
The Compendious English Grammar.

Cassell and Co., Limited—
Cassell's Readable Readers. Infants, Parts 1 and 2; Standards I. and II.
The Making of the Home. By Mrs. S. A. Barnett.

Hachette et Cie.—
Société Nationale des Professeurs de Français en Angleterre. (Report.)

Heywood (John)—
Elements of Physiography. By J. J. Prince.
Hour Lessons on the Gospel of St. Mark. By Lewis Hughes, B.A.
Analysis of the Book of Joshua, Judges, and Ruth. By S. Bevan Davies.

Longmans and Co.—
Open Competition Hand-Books—French. By W. J. Chetwode Crawley, LL.D.
The Logic of Definition. By W. L. Davidson, M.A.
Longman's Magazine. May.
Shakspere's 'Coriolanus.' Longmans' Modern Series.
The School Manager's Manual. By F. C. Mills, M.A.

Marcus Ward and Co.—
The Oriel Readers Primer. Parts 1, 2, and 3.

Marshall (J.) and Co.—
Systematic Tests in Arithmetic. By J. F. Timpany.

Nelson (T.) and Sons—
The Royal Home Lesson Books.

Simpkin and Co.—
The Children's First Verse Book. By J. S. Laurie.

Smith, Elder and Co.—
The Cornhill Magazine. May.

Swan Sonnenschein (W.) and Co.—
Common-Sense French. By H. Pooley and K. Carnie.
The Evagoras of Isocrates, with Notes. By H. Clarke, M.A.

Science Notes.

MR. CLEMINSHAW has recently explained, in a paper read before the Physical Society, how the phenomena in spectrum analysis usually shown upon the screen may be exhibited without the aid of the electric light. The method employed depends upon the use of the lime-light. To obtain the spectra of the alkalies and alkaline earths, hydrogen is generated in a bottle containing, say, a strong solution of sodium chloride, by means of zinc and hydrogen sulphate. Hydrogen gas can also be passed into the bottle to assist in carrying over the spray of the sodium chloride. The mixed gases can then be burnt from a jet in the usual way. The result is a bright mono-chromatic flame. If strong solutions of sodium, lithium, and calcium chlorides are used, with two CS_2 prisms, five bands can be shown on the screen.

* * * *

THE COLOUR OF THE SUN.—If most of us were asked what was the colour of the sun we should doubtlessly reply, yellowish-white. Professor Langley has recently given reasons for believing that if we could see the sun's face as it would appear from a point outside our atmosphere, we should pronounce it to be blue. The atmosphere acts like a coloured glass roof or optical sieve, holding back the excess of blue in the original sunlight, and letting only such a sum of radiations reach us as we have been accustomed to call white. It is contended that the sun's light is bluish because of the excess of blue which it contains, and that the atmosphere is really of an orange colour, which stops the excess of blue, leaving the remaining colours in due proportion to form white light. It will be seen at once that if there be any truth in this novel conjecture, the higher we rise, the less would be this atmospheric absorption. It is impossible to rise to the surface of the atmosphere, but quite practicable to climb a mountain so as to leave half the atmosphere below us. Professor Langley selected one of the peaks of the Sierra Nevadas in South California, where the air was exceptionally dry and clear. Two sets of observations were made, one at the base of the mountain, the other at an elevation of 18,000 feet. The intensity of the radiations all along the spectrum were estimated by a delicate instrument invented by the professor, and called the Bolometer, or ray measurer. The spectrum was obtained by the use of a diffraction grating, which, it will be remembered, gives a normal spectrum. Having estimated the value of the solar radiations in every part of the spectrum, the professor ascended the mountain. After much rough and difficult climbing, the upper camp was pitched some 12,000 feet above the level of the sea. Here the observations taken at the base were repeated. The sunlight entered a darkened tent, and was spread out into a spectrum, which was compared in every part with that examined before. All the radiations had increased in intensity but not in the same proportion. Towards the blue end the intensity had increased enormously, showing that it was here that the selective absorption of the earth's atmosphere had had most effect. Not only so, but the professor discovered radiations in the other end of the spectrum, which had not been observed before, owing to the fact that they had been rendered too feeble at low elevations for detection by the usual methods. The conclusion seems to be that the earth's atmosphere has a much more considerable effect upon the sun's radiations than has hitherto been supposed. The researches of Professor Tyndall have shown that the aqueous vapour in the air has an enormous effect in stopping the *infra* red rays. Professor Langley has now taught us that what we have been accustomed to call clear, transparent air even when perfectly dry, is after all a coloured medium, a sort of orange veil, sifting out by selective absorption the excess of blue light which comes directly from the sun, whose face, could we but rise above our roof to see it, we should declare to be blue. This investigation has an important bearing on the temperature of the sun, and points to its being intensely hot.

Books of the Month.

WE may at once say that the novels of the month which we have seen are all more or less disappointing. Some are certainly better than others, but there is not one that has made a deep impression, or that we feel we shall go back to again and again as to an old friend, loving it the more the more we know it.

***

'Betwixt my Love and Me,' by the author of 'A Golden Bar,' is a love-story built up from very well-worn material. We have all met, many a time and oft, the young *ingénue* who falls in love with her guardian; and we all know the guardian who passionately returns that love, but fails to understand the state of his ward's feelings. But if the *leit-motiv* of the book is well-worn, the manner of telling the story, and the drawing of the characters, are fresh and pleasant. Of course a villain comes 'betwixt' the lovers, and equally of course (though we are kept in suspense up to the very eve of the heroine's wedding the villain) all comes right in the end. Jack—Roland Kingdon—gets his Jill—Myrtle—and presumably they live happy ever after.

***

'In the Golden Days,' by Edna Lyall, is a historical novel—certainly one of the most difficult forms of the novelist's art; for the author must, if we may use such a term, *realise* for us characters with which we are already familiar; he must paint a bygone time for us in such wise that we may recognise its historic truth and fidelity. Considering the great difficulties of her task, Miss Lyall has been, to a certain extent, successful. The love-story of Hugo and Joyce Wharncliffe, the troubles and misfortunes of their lives, are told very tenderly; the relations of Hugo to the celebrated Algernon Sidney, on which the whole story turns, is full of interest. Its date, it will be seen, is in the days of Charles II., and we meet such well-known characters as Judge Jeffreys, John Evelyn, Betterton the actor, Francis Bampfield, and the 'little Duchess' of Grafton.

***

'Anthony Fairfax'—we believe, the 'first work of fiction' of its author—is a simple and not at all unpleasing story. Many of its characters are skilfully drawn, and not without a certain humour. The hero, Anthony, has been unjustly imprisoned, but how and why, and the manner of his final exculpation, and his love affair with pretty Beatrice Clare, readers must find out for themselves. We will not spoil their pleasure by betraying the secrets of the third volume.

***

In 'Louisa' Mrs. Macquoid takes us to Italy, and into the company of Count Giuseppe Monaldi and his English wife Louisa Jeffersen, of his niece Francesca Varese and of his English friend Francis Hobart. The interest of the story lies in the opposite natures of the two women, the aunt and niece, and in the various troubles that spring therefrom. Both characters are interesting, and drawn with a

firm hand; that of the wife, Louisa, is a fine psychological study. The story itself is well told, and there are also some charming descriptions of the Italian town where the characters live. This town is only alluded to somewhat mysteriously, and never by name, but it is evidently intended for Perugia.

***

Mr. A. P. Sinnett, of 'Theosophic' fame, has written a novel—'Karma.' We need not say there is the full complement of *clairvoyantes*, magicians, thought-readers, and other necessities of 'occult science.' Those who believe in theosophy may find the book interesting; for ourselves, we confess we have not been able to get through it to the bitter end. 'A Millionaire's Cousin,' by Miss Lawless; 'A Morganatic Marriage,' by Miss Connor; 'Not Drowned,' by Anthony Bathe; 'The Old Corner House,' by L. H., are all of them new novels—neither better nor worse than dozens of others like them.

***

A book which, albeit not a novel, has all the charm and interest of the most exciting romance, is Mr. Hyde's 'The Royal Mail.' Mr. Hyde has been a Post-office official for over twenty years, so that he is naturally quite *au courant* of the work done at the Post-office, and gives us much information as to the management of all the departments under the present Post-office system. How vast this system is few persons really know. But amusing and interesting as these details are, perhaps even more so is the history of the many changes through which the 'Royal Mail' has passed before attaining its present proportions. Starting with its very earliest days, when letters were still entrusted to 'post-boys,' Mr. Hyde leads us through its history, giving us every kind of information on all the stages of its development. But while the book is a really valuable history, it is never for a moment dull. Anecdotes of the brightest and most amusing kind are to be found on every page; stories full of 'sentimental' and romantic interest, and stories full of humour abound. The illustrations are all excellent, while the *fac-similes* of strangely or illegibly addressed letters will be found quite irresistibly comic. Altogether, it would be difficult to speak too highly of Mr. Hyde's delightful volume.

***

One of the literary events of the month is the appearance of Mr. Leslie Stephens' 'Dictionary of National Biography.' So far as a hasty examination of its contents permits us to judge, it seems to us, in many respects, an improvement upon the first volume. Less space is given to persons of little general interest, or about whom specialists only would want information. The information is here also given, but at less inordinate length—at least in most cases—than in Volume I. We note one or two exceptions, however. Thus, *e.g.*, it is not a matter of very great moment that Princess Augusta Sophia, daughter of George III., on one occasion danced with her brother, and on another was present at a marriage ceremony. Again, Eugene Aram's life is not only given, but Dr. Garnett has added some very interesting remarks on the differences between the real and the Lyttonian Aram. It may be urged that Aram was a philologian; but, after all, he made no mark as such, and he is really known only because of the murder he committed, or helped another man to commit.

***

The biography that will probably attract most attention—(this volume takes us from 'Annesley' to 'Baird')—is that of Francis Bacon. Professor Gardiner, who has written his 'Life,' thus sums up his character: 'He was too great a man to play any other than a second-rate part in the age in which he lived.' The 'Works' of Bacon are dealt with by Professor Fowler. The biography of the earlier and great namesake of the Chancellor, Roger Bacon, by Professor Adamson; of Roger Ascham, by Mr. S. L. Lee; of Jane Austen by the Editor, will be found among the most attractive in the volume.

Those who have lately read Mrs. Fenwick Miller's 'Biography of Harriet Martineau,' and the correspondence called forth by it between her and Dr. Martineau, will be interested in the appearance of his work on 'Types of Ethical Theory.' Whether we hold Dr. Martineau's opinions or not, whether we accept or reject his ethics, this book is certainly a remarkable one, coming from a man of over eighty years, full as it is of all his early vigour and energy.

***

Last month we announced the publication at an early date of Stepniak's book, 'Russia under the Tzars.' This has now been issued, and all wishing to understand, not merely the present condition of the Russian Empire, but the events and circumstances that have brought about the present condition, should read this work. The accounts of the Russian 'Mir' (agricultural communes), and of their government, of the Russian peasants, working men, students, etc., of the struggle that is going on between the Tzar's Government and all Russian Liberals, are especially valuable. Those who have read Stepniak's 'Underground Russia' will not need to be told how interesting must be that portion of his work which deals with the State prisons, and with Siberia and those exiled thither.

***

Among the many 'Books of Travels,' one is 'Studies in Russia,' by Mr. J. C. Hare, which we cannot recommend our readers. Mr. Hare says he passed only one summer in Russia, hence, where accurate, his remarks are all of the most superficial kind, but often his statements are quite unreliable.

***

A very readable history of the Transvaal is by Mr. Nixon ('The Complete History of the Transvaal, from the "Great Trek" to the Convention of London'); and a very bright, pleasant work, 'The Trottings of a Tender-Foot,' by Mr. Clive Phillips Wolley, deals with British Columbia and Victoria. In 'Burma and the Burmans' Mr. Archibald R. Colquhoun, special correspondent of the *Times*, gives some valuable information. His account of the religion (Buddhist) of Burma, of the spread of education, of the land laws—which should make land nationalisers rejoice—of the general state of the military forces and government, is most able; and the admirable map of Indo-China adds not a little to the usefulness of his book. Another work which is sure to be read with interest at the present time is one by Mr. Scott, on 'France and Tonking.'

***

The most fascinating autobiography we have seen for a long time is that of Sir Henry Taylor. The author of 'Philip van Artevelde' was of course intimately acquainted with all the great or well-known men and women of the last generation, and it is full of a strange, almost pathetic interest, to hear this man of eighty-five telling us about his friends—now dead so long!—Southey, Wordsworth, Coleridge, all the *habitués* of Holland and Lansdowne Houses, and of Carlyle—in his younger days—Lady Harriet Baring (who caused poor Mrs. Carlyle so many a heartache!), 'Young Tennyson,' and all the others. The two volumes will not easily be put aside when once begun, they are so full of exquisite portraits of men and women we all like to know about, of keen observation and kindliness withal.

Publications Reviewed.

Over-Work from the Teacher's Point of View.

By Mrs. W. Bryant, D.Sc.

We need hardly say that whatever Mrs. Bryant writes on education is worthy of serious consideration. Few are more capable of forming an opinion, or more able to express it. The present essay includes a careful psychological analysis of the conditions that lead to what is called over-pressure. Mrs. Bryant rightly thinks we

should *wish* to be healthy, and act accordingly. She is an earnest disbeliever in the outcry against over-pressure. We are by no means alarmists. We cannot, however, agree with the author in thinking that over-pressure does not exist, and a good deal of it. The question is partly one of definition and partly one of fact. If by over-pressure we mean working too hard, and for too many hours, we have then only to collect facts, to prove the case. Teachers of long experience ought to be able to form a definite judgment on the matter; and parents who see their children working two or three hours in the evening should be allowed to express their opinion. The whole subject is under investigation, and, for our own part, we are pretty sure what the ultimate verdict will be.

Gardiner's Explanatory Geography. Part I. for Standards I. and II. Part II. for Standard III. With Maps and Diagrams. By Alfonzo Gardiner. London: John Heywood.

In these little books, adapted to the "Mundella Code," is to be found not only an abundant store of useful and interesting information, but also many valuable suggestions for the teacher. We doubt, however, the advisability of cumbering small text-books for young learners with elaborate and learned notes for the teacher's guidance. For example, on page 21 of the part for Standard II. is inserted a long note, consisting of extracts from *Knowledge*, which occupy nearly twenty lines of very small print, and combat, from a scientific point of view, the popular definition and the ordinary conception of a volcano. The importance of forming correct notions as early as possible cannot be denied; but a Second Standard book is hardly the place for such a statement as the following:—'The three essential conditions for the production of volcanic phenomena appear to be:—(1) *Apertures or fissures*, affording communication with the interior of the earth; (2) *highly-heated matter* beneath the surface; and (3) *subterranean water*, which, in the form of high-pressure steam, is competent to produce all the crater operations.' Mr. Gardiner is undoubtedly an able practical teacher, and his work will well serve one of its purposes, for it will help teachers by furnishing a plan and matter for a course of oral lessons which no book can make needless. As illustrations of the fulness of the information, we may note that in Part II. nearly three closely-printed pages are devoted to facts respecting London, and five or six pages to facts about English manufactures. The systematic indication of accent and pronunciation of proper names, and clearly-printed sectional maps, form valuable features of these books. Differences of type may be useful in many cases to denote varying degrees of importance, but they are likely to prove confusing to young readers; and though the type is very clear, much of it is so small that it must be trying to young eyes.

Langton's Examples in Arithmetic. By J. Langton, M.A. London: Thomas Murby.

This is a book of examples only, but it claims to be new, practical, and systematically graduated in accordance with the latest code. Its claims, we are bound to say, seem to be fully justified. There can be few books of the size capable of affording so much real work in arithmetic. We have heard it objected to some books of examples that they do not contain enough exercises with many figures to afford due preparation for the tests of accuracy applied by certain examiners; but no such objection would hold against this work. As examples, we may mention that on one page there are no fewer than 150 exercises in short division, with twelve digits in each dividend; on another page there are 80 or more exercises in compound multiplication, with five figures in the pounds, and multipliers of three and four digits. We are by no means sure that constantly working with large numbers is educationally the most reasonable plan to adopt in teaching the practice of arithmetic; but, as the requirements of the Code are sometimes interpreted, it becomes necessary for teachers to seek books affording the practice demanded, and they will find one to suit them in Mr. Langton's work. It should be added that mixed questions of the kind it is common to call problems are introduced in great number and variety, and the exercises for the higher standards are as numerous and various as those in the earlier rules. The book can be obtained in separate parts for the seven standards, and books of answers are issued at a low price. The type is clear and of fair size, particularly in the lower standards.

Young England School Series: Arithmetic for Standards I. to VI. London: Jarrold and Sons.

The various numbers of this series consist of examples only, with the addition of tables in the lower standards. The exercises are given in sets of four, five, or six questions, and are thus very suitable for home lessons, and will also enable a teacher to apportion the work in arithmetic lessons conducted by junior assistants. The books will scarcely afford sufficient practice for a whole year, but the examples are most carefully graduated, and illustrate almost every possible form of arithmetical question. Problems are introduced at a very early stage, and exercises on the rules previously learnt are given in almost every set. This keeping up of back work is a most valuable and necessary feature; and another point which will recommend these books to teachers is the fact that a large proportion of the questions are marked as having been actually given by H.M. Inspectors.

Hints on French Syntax. For the use of Merchant Taylors' School. By F. Storr. London: W. Rice, Fleet Street.

This is an attempt to include in a few pages the really essential points of French Syntax. We most cordially recommend this little book to teachers and students. It is the result of much knowledge and experience, the work of one who has an intimate acquaintance with the subject, and an equally clear perception of the difficulties and requirements of beginners. The author points out most justly that grammar is but a subsidiary, and not the chief instrument, in acquiring a mastery of the language—a fact very often entirely overlooked. In 24 pages we have what, in the opinion of a competent judge, cannot safely be omitted. The book is interleaved, so that whatever the reader may wish to add can be inserted in its proper connection. It does not profess to be complete. Those who do not see everything in it they would like must remember that the author prides himself most on what he has omitted.

Elementary Practical Chemistry and Laboratory Practice. London: J. Boulton and Co. Part I.

This work has reached a second edition. It is adapted to the first stage of the revised syllabus (1882) of inorganic chemistry (theoretical and practical) of the Science and Art Department. It may be fairly admitted that it is quite suitable for that purpose. The author has come to the conclusion that the only way to teach chemistry is to enable the pupils to perform experiments for themselves, and he is undoubtedly right. Chemistry must be learned in the laboratory, and not merely in the lecture-room.

We should have been glad to see a little more theory. Some of the experiments, too, are done in an antiquated way. Professor Armstrong showed, in the Health Exhibition, an exceedingly neat and easy way of performing the experiment numbered 19 in this book.

The list of experiments drawn-up by Dr. Roscoe and Dr. Russell is given at the end of the volume. We trust this list, excellent as it is, will soon be revised or withdrawn. It is time to move forward. It is a curious testimony to the belief in official infallibility that the misprints in this list are copied without correction. But they were copied, and not corrected, when the list was lately published in *Nature*.

Odds and Ends of Useful Knowledge. For Junior Students preparing for Oxford and Cambridge Examinations. By a Lady. London: Relfe Brothers.

The 'Lady' tells us, in the preface, she has been tempted to publish this collection of odds and ends. One cannot but wish she had resisted. In this wicked age there are not wanting those who disbelieve in the efficacy of examinations, even Oxford and Cambridge examinations. We earnestly hope these 'odds and ends' will not fall into their hands. Will a 'Lady' pardon us if we venture to suggest that whenever she is tempted to write another book she should recall these simple words, *obsta principiis*. We are not without hope, for she has withheld her name and the name of her school.

Elementary Algebra. Part II. London: Blackie.

This is the second part of an elementary algebra for schools. It contains 64 pages, and deals with simple equations, factors, G.C.M. and L.C.M., and fractions. It is a cheap, well-arranged, and clearly-printed book. The price is threepence in paper cover, fourpence in cloth.

Pinkerton's Trigonometry. London: Blackie and Co.

There is no lack of good elementary text-books on trigonometry. We are of opinion, however, that the one before us will find a place and retain it. There are nine chapters, covering 150 pages. The matter is well arranged, and admirably printed. It is professedly an elementary work, but it contains enough for an ordinary pass degree. A little knowledge of trigonometry is almost essential for students studying mechanics, optics, and electricity. A book like this, which gives them all they want clearly and accurately, omitting whatever is not essential, is sure to become popular.

First Lessons in German Reading. By Fräulein Jagst. London: Cassell and Co.

This little book, with illustrations that are likely to please the little ones for whom it is meant, is to supply 'simple, short, and amusing' stories for young children, before they enter 'into the more complicated study of grammar.' The suggestions that children should be taught to understand and read a language before being wearied and worried with its grammar, and that they should 'learn by heart,' are excellent. We can only regret that all the stories given are not so good as they might be, and we regret it the more because many of the selections are quite satisfactory, and because the editing of the book is very careful. We have such delightful nursery rhymes and fairy tales in German that we sincerely hope Fräulein Jagst may use them in another edition, in preference to some now printed, which are not 'simple,' merely silly. For example, what would a very little child—and, of course, the book is intended only for them—make of this: 'Muthig . . . . ergriffer den Pinsel, und vollendete sein herrlichste werk, Das Opfer der Iphigenie. Denn der Name des Künstlers war Thimanthes?' Babies in the nursery love 'Eisernen Hejnrich,' and 'Schmeewitchen,' and 'Däumeling,' and 'Hans im Glück.' They know nothing of Timanthes, and of Iphigenia they have probably not yet heard.

Chaucer. The Tale of the Man of Lawe. London: W. and R. Chambers.

This is one of the best school editions of a 'Canterbury Tale' that in much Chaucer-work we have seen. Its author is evidently a man thoroughly competent to deal with his subject, and unlike many Chaucerian editors, competent to deal with something more than questions of etymology and grammar. His work has clearly been a labour of love. He has genuine enthusiasm for our beloved old poet, and has got at the very 'heart of his song.' Only teachers know how such real and honest enthusiasm helps young students.

Besides a short preface, this little volume contains a 'Life' of Chaucer, chapters on his 'grammar' and 'versification,' the 'Tale' itself, 'notes,' an 'etymological glossary and index,' and some 'examination papers.'

The 'Life' is very accurately and pleasantly written, with the breath of the 'monethe of May' and 'fresshe floures' we should have in dealing with Chaucer. We note, however, that the date of Chaucer's birth is quite positively affirmed to have been 1340. We ourselves believe the evidence in favour of this (or approximately of this) date to be overwhelming. Still, it would, perhaps, be better to point out that there is considerable doubt on this head, the more so as in many books students will find the year 1328 given as the birth-year. The whole account of Chaucer's 'person' is very charming. We miss only two of the delightful little touches of the 'Host's' description—

> 'For ever upon the ground I se the stare.'

And—

> 'He seemeth elvisch by his countenaunce,
> For unto no wight doth he daliaunce.'

It would also be wiser to give either a complete list of Chaucer's works, or to state distinctly that the list given is not a full one.

The chapters on Chaucer's grammar and versification are really admirable; it would be difficult to find any fault with them. The 'Tale' has been taken, in the main, from the 'Ellesmere' MS., as printed in Mr. Furnivall's Six-Text Edition. Only here and there the editor has preferred readings from the other MSS. But these cases are so few and far between that for all practical purposes we may call this the Ellesmere text—in itself a wise choice. Throughout the first part of the 'Tale,' final *es* and the final *e*'s that form a syllable have wisely been marked by two dots. We regret the plan was not used from the beginning, with the 'introduction' to the prologue and the prologue. The editor assumes that students are likely to begin with the 'Tale,' and leave the prologue to the last. But to such an arrangement every judicious teacher would object.

The 'Notes,' in which the editor modestly says he '*attempts* to deal with the difficulties that occur in the poem,' really deal with them most satisfactorily. All necessary facts and details are given, while there is no hint at pedantry. The glossary and index—the reviewer, having compiled glossaries, speaks *en connaissance de cause*—leave nothing to be desired. The 'examination questions' at the end of the book will be found useful by teachers as giving good examples for setting questions of this kind. Altogether this edition of the 'Man of Lawe's Tale' of 'Pious Custance'—surely one of the most delightful of all the Tales—should prove equally valuable to teachers and pupils.

Chambers's Graduated Readers. Book VI. London: W. and R. Chambers.

This volume is a clearly-printed, well-selected, and carefully-annotated collection of extracts for reading. Some three or four lessons on moral subjects, as Thrift, Temperance, Selfishness, have been specially written; all the rest are taken from the works of standard authors. The works of Macaulay, Ruskin, Helps, Kingsley, Thackeray, Dickens, Jefferies, and the older English classics have been laid under contribution. Several of the poetical extracts are marked as suitable for recitation by classes in Standard VI.; exercises in English for the same standard are appended to every lesson, and at the end of the book is a list of words for revisal.

Two Snowy Christmas Eves. By Eliza Kerr. Wesleyan Sunday School Union.

This is a pretty tale about two children who were stolen from their parents when very young. It is sure to please our little girls, who will be deeply interested in pretty Nellie's restoration to her rightful home, and they will love Judy for her sisterly devotion. The type is clear, the illustrations fair, and the binding attractive.

Practical Algebraical Test Cards. D. Bain, B.A. London: Longmans and Co.

These cards are arranged in three packets, each containing 36 cards. They have been specially prepared to meet the requirements of the revised Mundella Code. The examples are carefully chosen and graduated. The author, no doubt, believes that a boy who could work through them would have no difficulty in satisfying the Inspector. In many cases this would be so, but not in all, if some of the questions which have been sent to us are specimens of what is demanded for a pass.

Course of Arithmetic. By T. B. Ellery. London: W. and R. Chambers.

This is a sound fourpenny manual, intended for Standard VII. It is well arranged and clearly printed. We are sorry not to find short and precise definitions of the most important words employed. A boy ought to be able to state exactly what the square of a number is, and what is the square root of a number; what he means by average, percentage, etc. In regard to the terms discount and present worth, this information is supplied.

Algebraic Factors: Resolution of Elementary Algebraic Expressions into Simple Factors by Easy Methods. By Robert Graham, M.A, Senior Moderator in Mathematics, Trinity College, Dublin. Simpkin and Co.

In reading the preface of this valuable little work, in connection with the position of the author, we vainly hoped that we had found another example of a great teacher condescending to instruct very young minds. The preface speaks of the difficulty to *beginners* the subject always presents, and goes on to state that 'the first two chapters treat of the elementary part of the subject, and that the remainder can be read by the student who is acquainted with algebra as far as simple equations.' We do not know the order in which the different parts of Algebra are taken in Irish elementary schools, but we do know that an English student who was not supposed to know simple equations would be very much astonished to be asked in an examination paper to prove that $n(n-1)(x-a)^2(x^{n-2}-a^{n-2})-6n(x-a)(x^{n-1}+a^{n-1})+12(x^n-a^n)$ is divisible by $(x-a)^3$; and we very much doubt if one out of ten thousand who pass quite advanced examinations in the subject ever saw the symbol Σ, which is used frequently in Chapter II. and its sets of examples. We do not say this for one moment in condemnation of the book; nay, we admire and value it and its splendid collection of examples immensely; only we doubt the correctness of the title-page. At the same time, the simpler forms are carefully explained, and the methods given of many forms incapable of failure, though some of these methods are lengthy.

When the author comes to treat of expressions of the third degree (still in Chapter II.), he states, fairly, that the problem, except in some particular cases, cannot be solved satisfactorily without the aid of the methods employed in the theory of equation; and we cannot help thinking that he might have suggested in the case of quadratic expressions what he had allowed in the case of cubic expressions—*e.g.*, to resolve $2x^2+5x+2$, he first makes the coefficient of x a perfect square, by multiplying by 2; he next substitutes y for $2x$, and resolves the resulting expression into its elementary factors, which have to be reduced back, by writing $2x$ for y. This, of course, ensures the success of the problem, but is very lengthy; and the old method of making trials, combining the different factors of the coefficients of x and the absolute term, so that the sum of the two products should equal the coefficient of x, might be at least hinted at.

The second chapter, on symmetrical expressions, is very clearly written. The third and fourth chapters are on Horner's method of synthetical division and imaginary factors respectively. The examples attached to each exercise, of which there are no less than twenty-six, are, as we have hinted, very numerous, varied, and carefully arranged with regard to difficulty, rising, in nearly every case, to questions of considerable difficulty, only to be approached by an 'Honour' man.

To advanced students and teachers we heartily recommend the work; but for boys and girls it is not adapted.

Being only bound in paper, we presume it is very cheap; the printing, however, is all that could be wished. We might mention the symbol $\equiv$ (instead of $=$) is used for 'identically equal to.'

Trojan War. By Professor G. Witt. Translated from the German by Frances Younghusband. London: Longmans.

Professor Witt seems to be to German children what our own Professor Church is to English children. He delights in telling the old stories in language and style suited to their capacities and years. The Head Master of Westminster would fain launch this translation on the sea of English schools, believing it to be a 'pure gain that schoolboys in the later years of their school life should approach the "Iliad" with that familiarity with its matter which such a volume as the present . . . . will, without fail, have given.' He also cannot but hope that a certain amount of culture may be got from such books, and that they are better for lads to read than many so eagerly devoured at the present day.

Beautiful as the work, and simple as the translation is, of course the fire of the story, as depicted in the original, is altogether lost. There are the same stirring events told, but the majestic roll of the verse that told them is necessarily gone.

The quotations from the 'Iliad' are never given in any attempt of metrical form, original or otherwise. In this, probably, the translator has exactly followed the author. Were an English writer telling the story, it would, perhaps, be hard for him not to attempt something of the kind, or to quote from some metrical translation extant.

The little book (93 pp.) is beautifully printed and bound, being supplemented by an index of names and places.

The Child's First Lesson Book in Geography. By M. J. Barrington Ward, M.A., F.R.G.S. London: Marcus Ward and Co.

Though the title-page tells us that Mr. Barrington Ward has written a book called 'The Child's Geography,' he gives us no preface to tell us why he has also written this one. But whatever his reason was, it is exactly suited or to be used, as we believe it was intended to be, as an early reading-book in elementary schools. for a teacher or mother to read to her little children, There are no numbers—plenty of pretty (in some cases really beautiful) full-page pictures of lovely spots on the earth's surface, and maps (with a very few names) of some little bit of a country, to illustrate what the talk is about. As an example, when describing fens, he gives a small marginal map of Lincolnshire, or when he wants to explain an isthmus, he only draws the Isthmus of Panama, with very small portions of the continents joined. The lessons, of which there are forty-one, are each about a page, or a little more. Several short poems by Mrs. Hemans and from Lilliput Levee, as well as others, are introduced. Difficult words are explained at the end of each chapter, and the long words, divided into syllables, are also collected together. The book is so charmingly written, one might almost call it a play-book on geographical notions.

The Sun and His Phenomena. By the Rev. T. W. Webb. London: Longmans.

Why 'his'? is the first question we are tempted to ask, after a conscientious reading of this book. And why 'phenomena'? and, above all, why has the book been published? The 'his' question is prompted by the fact that throughout the seventy-eight pages Mr. Webb oscil-

lates between making the sun masculine or neuter; and one cannot help thinking that any of the unfortunate children doomed to read him, and acquainted with German, may wonder why he does not sometimes write of the sun as 'she.' The 'phenomena' question is due to the fact that Mr. Webb's spelling of this word is variegated. Sometimes, as in his title-page, the spelling is as we have written the word; sometimes, as on page 71, we have 'phænomena.' But the most serious question is our third. We could not have believed that any one could have made a subject so fascinating as the sun as profoundly uninteresting as Mr. Webb has made it. A book so disorderly, unsatisfactory, cloudy, we have rarely seen. Of absolute blunders there are not a few. Astronomy is called the first of sciences. Without being a Positivist, we can, most of us, endorse Comte's order in the hierarchy of the sciences. Whether 'first' means most fundamental, or highest and most complex, Astronomy cannot claim the title. In the former case, Mathematics, in the latter Sociology, is to be named as first. Nor is Reáumur's [*sic*] thermometric scale 'used chiefly in France' (p. 56). The space between the freezing and the boiling points of water is not divided into 100°, but into 100 degrees—a very different thing. And the apology for the Fahrenheit scale, at the expense of the Centigrade, shows an equal misunderstanding of thermometric registration and of children's minds. Again, to speak of electricity and magnetism (p. 76) as 'defying the research of man' is simply nonsense. When children are gravely told, after the wonderful advance in our knowledge of the sun's composition, that 'there are many elements up there of the nature of which we never shall have any conception,' and the words 'Hitherto shalt thou come, but no further,' are quoted. Mr. Webb has gone beyond nonsense into a region where we do not care to follow him.

But worse than the blunders is the hopeless confusion. Mr. Webb starts with the question, What is the size of the sun? Of course he must first teach his victims what is the distance of the sun. This he tries to do by the aid of the very worst account of the parallax we ever read. The size is not dealt with for twenty-five pages. Why should a young student be confused by this reversal of the order of questions? Exactly the same kind of thing is done in respect to the sun-spots (p. 40). A number of questions are asked about them, and then off Mr. Webb goes to describe, not the spots, but the surface of the sun itself. As an instance of the slovenly style of the writing, let us, in conclusion, quote one sentence which ought to have been at least three: 'There is no rule as to the quick or slow breaking out or closing up of these spots, or the whole time of their duration; but none are [*sic*] absolutely permanent, though there have been strong suspicions that after disappearing they sometimes return in their former places; and their existence is never very long, ranging from a few days to as many months; in the latter case, of course, passing away from the disc and coming round again from behind it at the opposite limb; the longest duration recorded is eighteen months.'

White's Grammar School Texts. Virgil's Æneid. Book VII. London: Longmans.

Another book of the Æneid belonging to this excellent series reaches us. All that we said of the 12th book might be safely re-said of the 7th, although the orderly critic pleads guilty to a little bewilderment at having to notice Book VII. after Book XII. He feels a mild interest in the sequence of the issues of the Virgilian books under the editorship of Dr. White, or, at all events, in the sequence of their outsending for review. As a measurable indication of the care and trouble expended on these texts, vocabularies, grammars all in one, we may point out that whilst the 817 lines of Virgil occupy only 28 pages and a fragment, the vocabulary occupies 169 pages. But this vocabulary is, as we have hinted, much more than its mere name implies. It is a grammar, a Lemprière, a history, a geography, a condensed treatise on philology. Thus we turn at random to '*pigeo*,' and find information as to the case it governs, its principal parts, its use as a unipersonal (still unhappily called 'impersonal') and as a personal verb. Or we look up 'Hercules,' and find as much of his story (which is not necessarily history) as a boy need know. In like fashion with 'Consul' or with 'Latium'; while interesting and acute side-references to the Greek abound.

Johnston's Intermediate and General Geography; with Specimens of Examination Questions recently set. By R. Johnston, F.R.G.S. London: Longmans and Co.

Here we have a very different book, and intended for a different class of children; full, too, as such geographies must be, of names, numbers, and hard words.

There are two pictures, both of which occur in the introductory chapter. There is a paragraph on the atmosphere, which struck us as one of the best-written in the book, numbers, happily, not having often to obtrude themselves.

We do not think the British Colonies have received due attention, though there is a condensed list of them at the end of the volume.

The book is strongly bound and well printed. Many facts are tabulated, as the counties of England, with the chief town of each, and the name of the river on which it is built. We do not say for one moment that the manual is any worse, nor less interesting, than any other of the same sort; but we cannot say that we find any advance in it. The great man has yet to be found to do for political geography what Tyndall, Roscoe, and B. Stewart have done for physical science.

Elementary Help-Notes on Latin. By W. Thornton Bullock, M.A. Relfe Brothers.

This little book will be more useful to Mr. Bullock's own pupils than to any one else. It is one of those kinds of books that so often meet the reviewer, that are not greatly needed, inasmuch as every good teacher of Latin will have a book of his own, as it were. That is, every skilled teacher will give his pupils, on his own account, all the hints that Mr. Bullock here collates, and possibly several others. Assuming, however, that a teacher is in want of guidance as to the special difficulties to be laid before and explained to his scholars (in which case he ought to be in want of scholars), this little volume will serve. It has its blunders. Thus, nouns substantive are said to name things, persons, places, and ideas (all of which are things). On page 8, the noun is said to be declined by 'number, case, and gender,' and on page 10, 'by number and case' only. In his anxiety to simplify the classification of adverbs, Mr. Bullock makes *huc* an adverb denoting 'where,' when he really means that it is an adverb of place. He does not give the exceptions to the rule for the vocative of *us*-nouns of the second declension. He talks of the *three* degrees of comparison, as if there were any comparison involved in *bonus*, *e.g.* His conjunction classification is not very helpful or explanatory. There are two printer's errors in the Latin, one of which, at least, may mislead beginners: *edimas* for *edimus*, page 9; *curat* for *curat*, page 27. Of useful points, we note the paraphrases to be used for the perfect active, and for the present and future passive participles, the necessity for the adjective with the genitive and ablative of quality in Latin when it is often omitted in English (*homo summi ingenii*, a man of ability), and the admirable directions and examples as to the transference from *oratio recta* to *oratio obliqua*.

The Public Schools Historical Atlas. Edited by C. Colbeck, M.A. London: Longmans Green, and Co.

Mr. Colbeck has here collected into a small, square volume the maps which have been published in the 'Epochs of Modern History,' of which he is now the editor. In addition to these, he has himself prepared those which were wanting to complete the series.

Before speaking of their object we may at once recommend the volume for its clearness of execution and beauty of appearance. The maps are carefully coloured, and not over-crowded with names so as to make them illegible. There are no less than 101, some full-page and some smaller, but all equally clear.

Though stated to be the maps from 'Epochs in Modern History,' yet the first gives us a sketch of the Roman Empire in the fourth century, taken from Church's 'Middle Ages.' There are several plans of battles, sieges, and towns, the atlas concluding with a plan of the battle of Waterloo.

At the foot of each map is the name of the book whence it is reprinted. We were particularly struck with the map of England giving the position of the battlefields of the Wars of the Roses, the towns besieged, other places of importance at the time, and nothing more.

Every teacher knows how important it is to teach one thing at a time, and that is just what these maps, either in the smallness of area depicted, or the fewness of names given, do.

At the end of the volume there is a well-arranged index, in which the places are discoverable by means of letters and Roman numerals, and not by longitude and latitude, though the longitude and latitude is, in nearly all cases, except in the battle plans, given.

The reason, no doubt, of this departure, which at first sight seems unwise, is to reduce the method of reference in towns—where longitude and latitude would be impossible—similar to that of larger areas.

Blackie's School Classics. 'The Tempest.' 'King John.' London: Blackie and Son.

This edition is, on the whole, very good. It is, of course, not so full or so complete as many others, but since it makes no pretensions, and is intended only to help the teacher, and to 'economize' his time, it will be found sufficient. The introduction in both cases is brief. With regard to the date of 'The Tempest,' while the editor is justified in saying that there is no proof of its having been Shakspere's (*à propos* we regret to see the name written Shakespeare) *last* play—though one would fain think it so—it would certainly have been well to point out that it must, from the internal evidence of style, metre, run-on lines, etc., have been *one* of the last. There are many years of mental growth and experience between, say, 'The Two Gentlemen of Verona' and 'The Tempest.' Julia, that early Viola, is very sweet, and who does not love Launce and his Crab? But what a distance between these and Miranda, Prospero, Ariel, Caliban!

With regard to the notes, these—though less full than they might be—are, on the whole, very good. But the word 'wench'—albeit mostly used in a bad sense today, is not always so used, even now. We all of us remember Mr. Tulliver's 'little wench' Maggie.

What we have said of the 'Tempest' applies equally to 'King John,' save that there is in this play one special difficulty with which the editor has not grappled. The scene between Lady Falconbridge and her son is very properly omitted. But surely *some* explanation is needed. In the list of the dramatis personæ, Philip is described as 'the bastard son to King Richard I.'; in the course of the play he is invariably called 'the Bastard'; and one of the notes is: '*I come one way, etc.*—a joking allusion to his illegitimate birth.' But no explanation of Falconbridge's relation to Richard I. is given; and an intelligent child will naturally ask for an explanation of what both the title and the 'joking allusion' mean. A few well-chosen words on the subject are absolutely necessary, and they are not forthcoming.

In the notes to both volumes grammatical ones are deficient; and in 'King John' we note one curious error. 'Cry havoc and let loose the dogs of war' is given as a quotation from 'Coriolanus.' We need not remind Shaksperian students that the line occurs in 'Julius Cæsar' (III. i. 273).

NEEDLEWORK! NEEDLEWORK!! NEEDLEWORK!!!

ALL PARTS NOW READY. EVERY GIRL SHOULD HAVE A COPY.

MISS JONES'S

SELF-TEACHING NEEDLEWORK MANUALS,

PROFUSELY ILLUSTRATED BY DIAGRAMS.

STANDARDS I. and II., in one Book	**Price 1d.**
STANDARD III.	**„ 1d.**
STANDARD IV.	**„ 2d.**
STANDARD V.	**„ 3d.**
STANDARDS VI. and VII., in one Book	**„ 3d.**

☞ **Complete Edition, in one Volume, for the convenience of Teachers, 1s.**

Now Ready, New Edition, crown 8vo, 3s. 6d. Specimen, post free, for 2s. 8d.

PLAIN NEEDLEWORK AND CUTTING-OUT.

By EMILY G. JONES,

Directress of Needlework to the Education Department.

With Original Plates and Illustrations, and a three-yards' sheet containing patterns, 'arranged so as to show the greatest economy of material.'

☞ *Miss Jones's Needlework and Cutting-out is now the ACKNOWLEDGED STANDARD WORK on the subject, and will be found indispensable to Head Mistresses and Teachers of Sewing.*

LONDON: JOSEPH HUGHES, PILGRIM STREET, LUDGATE HILL, E.C.

TWELVE LESSONS IN MODEL DRAWING.

By WILLIAM C. THIRDE,

Head Master, Science and Art School, Elgin, N.B.

(ENTERED STATIONERS' HALL.)

Directors, Managers of Boards, and Teachers of Schools and Colleges, supplied at 4s. per dozen copies.

SECOND YEAR CERTIFICATE.

DECEMBER.

Highly successful Coaching by Correspondence. Backward Students *made* to Pass. No fee unless successful first time. Very Low terms. Enclose envelope for particulars. GEORGE HENRY SPARROW, Forest-gate, London, E.

SCHOOL DESKS.

Prize Medal awarded, International Health Exhibition, London, 1884.

GEORGE E. HAWES,

ONLY

SCHOOL DESK MANUFACTURER

IN

EASTERN COUNTIES,

MAKER OF THE

EAST ANGLIAN

AND

NORWICH DESKS,

SINGLE, DUAL, & CONVERTIBLE.

Special Infant Galleries with Desk and Seats combined for Kindergarten. Pupil Teacher's Desk with Seat attached.

For Particulars apply

STEAM JOINERY WORKS,

DUKE'S PALACE,

NORWICH.

Specimens at South Kensington Museum.

Royal Fcap. 8vo, illustrated, strong cover, 6d.; cloth bound, 9d.

THE CHILDREN'S LIBRARY.

Edited by J. S. LAURIE,

Formerly H. M. Inspector of Schools, etc.

No. 1.

CHILDREN'S FIRST VERSE BOOK.

Adapted to English 'Class' Subject, Standards I. and II.

SIMPKIN AND CO.; HAMILTON AND CO.;

AND ALL BOOKSELLERS.

PRICE ONE SHILLING.

SCHOOL BOARD IDYLLS.

BY JAMES RUNCIMAN.

Contents:—1. The Widow Daley; 2. The Examinations; 3. Jimmy and his Teacher; 4. The Seventeenth Report; 5. The Scholarships; 6. 'When thou makest a Feast.'

'It shows that over-pressure is not a myth, but a great and terrible reality.' WARRINGTON GUARDIAN.

LONDON: LONGMANS, GREEN AND CO.

ENTERTAINMENTS FOR SCHOOLS, ETC.

HERR HUGO PROSKAUER (from the Royal Polytechnic Institution.) *Conjuring, Ventriloquism, Dissolving Views, Marionettes, etc.* Those wishing for an Entertainment, characterised by a performance of infinite variety, amusing, sparkling, and of exquisite finish, especially adapted for School Children, and ranking as the highest of its kind, should send for Programme to HERR H. PROSKAUER, Professor of Legerdemain, 29 and 31*f* New Oxford Street, W.C., corner of Museum Street.

Highest testimonials from Nobility, Gentry, and Clergy. Charges moderate. Suitable for Bazaars and Fetes.

HARMONIUMS, AMERICAN ORGANS, PIANOFORTES.

J. COOPER & CO.,

Scholastic Musical Instrument Manufacturers,

70, SHEPPERTON ROAD, NEW NORTH ROAD, ISLINGTON, LONDON, N.

WORKS: PEABODY YARD, ESSEX ROAD.

Sole Makers of "The Chorister" Organ (Registered). The cheapest and best organ in the world.

*** The Piano you supplied *Ten Years* ago has given the most complete satisfaction.
E. Bary, C.M., St. Clement's School, Notting-hill, W.

Some *Four Years* ago you supplied me with a most beautiful American Organ, which still continues to give entire satisfaction.
E. Jones, C.M., Manledd Board School, Llanidloes.

The Harmonium I purchased *Five Years* ago is quite a credit to you; although in constant use, it keeps beautifully in tune.
R. P. Jones, C.M., Little Aston, Birmingham.

Over 6,000 similar Testimonials have been received.

NO TEACHER SHOULD DECIDE WITHOUT SEEING OUR LISTS, WHICH ARE SENT POST FREE.

CUTTING-OUT A PLEASURE by a new system of proportions. All sizes of one garment learnt in one lesson by a class. Instructions with three patterns, 1s. 6d. Also stocking-scale, which can be learnt in five minutes, for all sizes, 7d.—M. GROUT, 4, Howard Street, Poplar, London.

SECTIONAL PAPER with Garments drawn as required for Pupil Teachers, third or fourth year, 1s. 6d. each. Also a Print Patch will be given, fixed and commenced by seam and overcast, with short Treatise on Needlework, 1s. Questions answered respecting needlework. —Miss GROUT, 4, Howard Street, Poplar, London.

SCHOLARSHIP: SPECIALLY RECOMMENDED PAMPHLETS.

1. 'OUTLINE NOTES' ON THE ORDER FOR MORNING AND Evening Prayer. 6d.
2. THE CHRISTIAN SEASONS, WITH QUESTIONS AND Answers. 6d.
3. THE LITANY, WITH EXAMINATION QUESTIONS AND Answers. 4d.
4. THE THREE CREEDS, WITH ANSWERS TO SET QUESTIONS. 4d.
5. A 'GUIDE' TO EXAMINATIONS IN RELIGIOUS KNOWledge. 6d.

Address: FIDUS ACHATES,
WESTPORT COTTAGE, WAREHAM, DORSET.

Tuition by Correspondence.

Six Years of Unparalleled Success. Results Unexcelled.

DEPARTMENTS—CIVIL SERVICE, LONDON MATRICULATION, QUEEN'S SCHOLARSHIP, CERTIFICATE UNIVERSITY LOCALS, SPECIFIC SUBJECTS, etc. Messrs. SKERRY, F.R.Sc., SMITH, M.A., CROMB, M.A., BARBER, B.A. (Hons.), NOTMAN (Hons.), and Co., rapidly and successfully prepare for all Examinations by correspondence.

Latest Civil Service Results. Over 200 Successes!

Clerkships, Men (age 17-20, Salary £80-£250), 2nd, 3rd, 4th, 5th, 9th, 16th, 27th, 31st, 37th, 39th, etc.; Excise (19-22, Salary £95-£300) 6th, 9th, 10th, 11th, 12th, 13th, etc.; Customs (19-25, Salary £55-£300), 3rd, 4th, 5th, 6th, 7th, 8th, etc.; Female Clerks (18-20, Salary £65-£80, etc.), 5th, 12th, 17th, 37th, 47th, 54th, etc.; Boy Clerks (15-17, Salary £36, etc), 3rd, 8th, 9th, etc.; Surveyors of Taxes (19-22, Salary £100-£400), 1st, 3rd, 4th, etc.

Highest places at all centres throughout Great Britain and Ireland.

Civil Service Guide and Prospectus (10th Thousand) post free from Mr. Skerry, F.R.S.S.A., of H.M.C.S., 7, Bell Yard, Temple Bar, London, W.C. Order the

'Civil Service Competitor,'

1d. monthly, of all booksellers, or sent free for 1s. 6d. per annum. Contains latest details, with Examination Papers of all Examinations, original articles, valuable hints, etc.

Before speaking of their object we may at once recommend the volume for its clearness of execution and beauty of appearance. The maps are carefully coloured, and not over-crowded with names so as to make them illegible. There are no less than 101, some full-page and some smaller, but all equally clear.

Though stated to be the maps from 'Epochs in Modern History,' yet the first gives us a sketch of the Roman Empire in the fourth century, taken from Church's 'Middle Ages.' There are several plans of battles, sieges, and towns, the atlas concluding with a plan of the battle of Waterloo.

At the foot of each map is the name of the book whence it is reprinted. We were particularly struck with the map of England giving the position of the battlefields of the Wars of the Roses, the towns besieged, other places of importance at the time, and nothing more.

Every teacher knows how important it is to teach one thing at a time, and that is just what these maps, either in the smallness of area depicted, or the fewness of names given, do.

At the end of the volume there is a well-arranged index, in which the places are discoverable by means of letters and Roman numerals, and not by longitude and latitude, though the longitude and latitude is, in nearly all cases, except in the battle plans, given.

The reason, no doubt, of this departure, which at first sight seems unwise, is to reduce the method of reference in towns—where longitude and latitude would be impossible—similar to that of larger areas.

Blackie's School Classics. 'The Tempest.' 'King John.' London: Blackie and Son.

This edition is, on the whole, very good. It is, of course, not so full or so complete as many others, but since it makes no pretensions, and is intended only to help the teacher, and to 'economize' his time, it will be found sufficient. The introduction in both cases is brief. With regard to the date of 'The Tempest,' while the editor is justified in saying that there is no proof of its having been Shakspere's (*à propos* we regret to see the name written Shakespeare) *last* play—though one would fain think it so—it would certainly have been well to point out that it must, from the internal evidence of style, metre, run-on lines, etc., have been *one* of the last. There are many years of mental growth and experience between, say, 'The Two Gentlemen of Verona' and 'The Tempest.' Julia, that early Viola, is very sweet, and who does not love Launce and his Crab? But what a distance between these and Miranda, Prospero, Ariel, Caliban!

With regard to the notes, these—though less full than they might be—are, on the whole, very good. But the word 'wench'—albeit mostly used in a bad sense today, is not always so used, even now. We all of us remember Mr. Tulliver's 'little wench' Maggie.

What we have said of the 'Tempest' applies equally to 'King John,' save that there is in this play one special difficulty with which the editor has not grappled. The scene between Lady Falconbridge and her son is very properly omitted. But surely *some* explanation is needed. In the list of the dramatis personæ, Philip is described as 'the bastard son to King Richard I.'; in the course of the play he is invariably called 'the Bastard'; and one of the notes is: '*I come one way, etc.*—a joking allusion to his illegitimate birth.' But no explanation of Falconbridge's relation to Richard I. is given; and an intelligent child will naturally ask for an explanation of what both the title and the 'joking allusion' mean. A few well-chosen words on the subject are absolutely necessary, and they are not forthcoming.

In the notes to both volumes grammatical ones are deficient; and in 'King John' we note one curious error. 'Cry havoc and let loose the dogs of war' is given as a quotation from 'Coriolanus.' We need not remind Shaksperian students that the line occurs in 'Julius Cæsar' (III. i. 273).

NEEDLEWORK! NEEDLEWORK!! NEEDLEWORK!!!

ALL PARTS NOW READY. EVERY GIRL SHOULD HAVE A COPY.

MISS JONES'S

SELF-TEACHING NEEDLEWORK MANUALS,

PROFUSELY ILLUSTRATED BY DIAGRAMS.

STANDARDS I. and II., in one Book	**Price 1d.**
STANDARD III.	**„ 1d.**
STANDARD IV.	**„ 2d.**
STANDARD V.	**„ 3d.**
STANDARDS VI. and VII., in one Book	**„ 3d.**

☞ **Complete Edition, in one Volume, for the convenience of Teachers, 1s.**

Now Ready, New Edition, crown 8vo, 3s. 6d. Specimen, post free, for 2s. 8d.

PLAIN NEEDLEWORK AND CUTTING-OUT.

By EMILY G. JONES,

Directress of Needlework to the Education Department.

With Original Plates and Illustrations, and a three-yards' sheet containing patterns, 'arranged so as to show the greatest economy of material.'

☞ *Miss Jones's Needlework and Cutting-out is now the ACKNOWLEDGED STANDARD WORK on the subject, and will be found indispensable to Head Mistresses and Teachers of Sewing.*

LONDON: JOSEPH HUGHES, PILGRIM STREET, LUDGATE HILL, E.C.

TWELVE LESSONS IN MODEL DRAWING.

By WILLIAM C. THIRDE,

Head Master, Science and Art School, Elgin, N.B.

(ENTERED STATIONERS' HALL.)

Directors, Managers of Boards, and Teachers of Schools and Colleges, supplied at 4s. per dozen copies.

SECOND YEAR CERTIFICATE.

DECEMBER.

Highly successful Coaching by Correspondence. Backward Students *made* to Pass. No fee unless successful first time. Very Low terms. Enclose envelope for particulars. GEORGE HENRY SPARROW, Forestgate, London, E.

SCHOOL DESKS.

Prize Medal awarded, International Health Exhibition, London, 1884.

GEORGE E. HAWES,

ONLY

SCHOOL DESK MANUFACTURER

IN

EASTERN COUNTIES,

MAKER OF THE

EAST ANGLIAN

AND

NORWICH DESKS,

SINGLE, DUAL, & CONVERTIBLE.

Special Infant Galleries with Desk and Seats combined for Kindergarten. Pupil Teacher's Desk with Seat attached.

For Particulars apply

STEAM JOINERY WORKS,

DUKE'S PALACE,

NORWICH.

Specimens at South Kensington Museum.

Royal Fcap. 8vo, illustrated, strong cover, 6d.; cloth bound, 9d.

THE CHILDREN'S LIBRARY.

Edited by J. S. LAURIE,

Formerly H. M. Inspector of Schools, etc.

No. 1.

CHILDREN'S FIRST VERSE BOOK.

Adapted to English 'Class' Subject, Standards I. and II.

SIMPKIN AND CO.; HAMILTON AND CO.;

AND ALL BOOKSELLERS.

PRICE ONE SHILLING.

SCHOOL BOARD IDYLLS.

BY JAMES RUNCIMAN.

Contents:—1. The Widow Daley; 2. The Examinations; 3. Jimmy and his Teacher; 4. The Seventeenth Report; 5. The Scholarships; 6. 'When thou makest a Feast.'

'It shows that over-pressure is not a myth, but a great and terrible reality.' WARRINGTON GUARDIAN.

LONDON: LONGMANS, GREEN AND CO.

ENTERTAINMENTS FOR SCHOOLS, ETC.

HERR HUGO PROSKAUER (from the Royal Polytechnic Institution.) *Conjuring, Ventriloquism, Dissolving Views, Marionettes, etc.* Those wishing for an Entertainment, characterised by a performance of infinite variety, amusing, sparkling, and of exquisite finish, especially adapted for School Children, and ranking as the highest of its kind, should send for Programme to HERR H. PROSKAUER, Professor of Legerdemain, 29 and 31, New Oxford Street, W.C., corner of Museum Street.

Highest testimonials from Nobility, Gentry, and Clergy. Charges moderate. Suitable for Bazaars and Fetes.

HARMONIUMS, AMERICAN ORGANS, PIANOFORTES.

J. COOPER & CO.,

Scholastic Musical Instrument Manufacturers,

70, SHEPPERTON ROAD, NEW NORTH ROAD, ISLINGTON, LONDON, N.

WORKS: PEABODY YARD, ESSEX ROAD.

Sole Makers of "The Chorister" Organ (Registered). The cheapest and best organ in the world.

"." The Piano you supplied *Ten Years* ago has given the most complete satisfaction.
E. Bury, C.M., St. Clement's School, Notting-hill, W.

Some *Four Years* ago you supplied me with a most beautiful American Organ, which still continues to give entire satisfaction.
E. Jones, C.M., Manledd Board School, Llanidloes.

The Harmonium I purchased *Five Years* ago is quite a credit to you; although in constant use, it keeps beautifully in tune.
R. P. Jones, C.M., Little Aston, Birmingham.

Over 6,000 similar Testimonials have been received.

NO TEACHER SHOULD DECIDE WITHOUT SEEING OUR LISTS, WHICH ARE SENT POST FREE.

CUTTING-OUT A PLEASURE by a new system of proportions. All sizes of one garment learnt in one lesson by a class. Instructions with three patterns, 1s. 6d. Also stocking-scale, which can be learnt in five minutes, for all sizes, 7d.—M. GROUT, 4, Howard Street, Poplar, London.

SECTIONAL PAPER with Garments drawn as required for Pupil Teachers, third or fourth year, 1s. 6d. each. Also a Print Patch will be given, fixed and commenced by seam and overcast, with short Treatise on Needlework, 1s. Questions answered respecting needlework. —Miss GROUT, 4, Howard Street, Poplar, London.

SCHOLARSHIP: SPECIALLY RECOMMENDED PAMPHLETS.

1. 'OUTLINE NOTES' ON THE ORDER FOR MORNING AND Evening Prayer. 6d.
2. THE CHRISTIAN SEASONS, WITH QUESTIONS AND Answers. 6d.
3. THE LITANY, WITH EXAMINATION QUESTIONS AND Answers. 4d.
4. THE THREE CREEDS, WITH ANSWERS TO SET QUESTIONS. 4d.
5. A 'GUIDE' TO EXAMINATIONS IN RELIGIOUS KNOWledge. 6d.

Address: FIDUS ACHATES,
WESTPORT COTTAGE, WAREHAM, DORSET.

Tuition by Correspondence.

Six Years of Unparalleled Success. Results Unexcelled.

DEPARTMENTS—CIVIL SERVICE, LONDON MATRICULATION, QUEEN'S SCHOLARSHIP, CERTIFICATE UNIVERSITY LOCALS, SPECIFIC SUBJECTS, etc. Messrs. SKERRY, F.S.Sc., SMITH, M.A., CROMB, M.A., BARBER, B.A. (Hons.), NOTMAN (Hons.), and Co., rapidly and successfully prepare for all Examinations by correspondence.

Latest Civil Service Results. Over 200 Successes!

Clerkships, Men (age 17-20, Salary £80-£250). 2nd, 3rd, 4th, 5th, 9th, 16th, 27th, 31st, 37th, 39th, etc.; Excise (19-22, Salary £95-£300) 6th, 9th, 10th, 11th, 12th, 13th, etc.; Customs (19-25, Salary £55-£300), 3rd, 4th, 5th, 6th, 7th, 8th, etc.; Female Clerks (18-20, Salary £65-£80, etc.), 5th, 12th, 17th, 37th, 47th, 54th, etc.; Boy Clerks (15-17, Salary £36, etc), 3rd, 8th, 9th, etc.; Surveyors of Taxes (19-22, Salary £100-£400), 1st, 3rd, 4th, etc.

Highest places at all centres throughout Great Britain and Ireland.

Civil Service Guide and Prospectus (10th Thousand) post free from Mr. Skerry, F.R.S.S.A., of H.M.C.S., 7, Bell Yard, Temple Bar, London, W.C. Order the

'Civil Service Competitor,'

1d. monthly, of all booksellers, or sent free for 1s. 6d. per annum. Contains latest details, with Examination Papers of all Examinations, original articles, valuable hints, etc.

MURBY'S IMPERIAL COPY BOOKS

"EXCELLENT." — *Rapidly finding their way into all good schools.* — "UNEXCELLED."

17 NUMBERS, PRICE 2d. EACH.

1. Half Text.	5½. Large and Small.	9. Small Hand.
2. Half Text.	6. Small Hand.	10. Small Hand.
3. Half Text.	6½. Double Small.	11. Small Hand.
4. Large and ½ Text.	7. Small Hand.	12. Small Hand.
4. Half Text.	7½. Three Hands.	12½. Ladies' Hand.
5. Small Text.	8. Small Hand.	

London: THOMAS MURBY, 3, Ludgate Circus Buildings, E.C.

CIVIL SERVICE.—Female Clerks, Men and Boy Clerks, Excise, Customs, etc. Candidates rapidly prepared through post on a thoroughly individual system. Upwards of 100 successes have been gained by members of these classes. Prospectus free on application to J. Keefe (of the Royal University), F.R.G.S., etc., Civil Service Academy, 171, Duke Street, Liverpool.

N.B.—Resident Pupils received.

DRAWING AND PAINTING MATERIALS.

Liberal Allowance to Schools. Send for Illustrated Catalogue, Post Free.

BRODIE & MIDDLETON,
79, LONG ACRE, LONDON.

GILL'S
WHITEHALL COPY BOOKS.
12 Nos.—6 Standards—2d. each.

'Beneath the rule of men entirely great, the pen is mightier than the sword.'

Teachers should use Gill's Whitehall Copy Books, which are renowned beyond all others for BEAUTY, SIMPLICITY, UNIFORMITY.

GILL'S
WHITEHALL LITERARY READERS

Are the only Standard Reading Books which have been specially compiled to suit the Code requirements of 1884, *and the modified conditions under which the subject must now be taught. They are extremely interesting, and most beautifully produced in every respect. Every teacher who desires a change should see them.* St. I., 9d.; St. II., 10d.; St. III., 1s.; St. IV., 1s. 3d.; St. V. (Voyages and Travels), 1s. 4d.; St. VI. and St. VII., 1s. 6d. all now ready.

USE CODE 1884.

GILL'S PENNY 'WHITEHALL STANDARD ARITHMETICS. Seven Standards, One Penny each.

GILL'S 'WHITEHALL ENGLISH,' CODE, 1884. St. II., 2d.; St. III., 3d.; St. IV., 4d.; St. V., 4d.; St. VI. and VII. 4d.

GILL'S STANDARD ATLASES. St. III., 3d.; St. IV., 4d.; St. V., 4d.; St. VI., 6d.

GILL'S GEOGRAPHICAL READERS.
THREE SERIES.

I. THE DESCRIPTIVE AND PICTORIAL SERIES. St. II., 9d.; St. III., 1s.; St. IV., 1s. 4d.; St. V., 1s. 6d.; St. VI., 2s.

II. THE WHITEHALL GEOGRAPHICAL READERS. St. I., 6d.; St. II., 7d.; St. III., 10d.; St. IV., 1s.; St. V., 1s. 4d.; St. VI., 1s. 9d.; St. VII., 2s.

III. THE 'ALBERT GEOGRAPHICAL READERS. St. I. 9d.; St. II., 9d.; St. III., 1s.; St. IV., 1s. St. V., VI., and VII., in the Press.

N.B.—The Albert Series of Geographical Readers have been produced to suit the exact conditions required by the Code, 1884-5, as to number of Lessons, etc. Every critic acknowledges that these are the finest specimens of elementary school-book production.

GILL'S HISTORICAL READERS.
THREE SERIES.

I. THE HISTORICAL READERS. In Periods. No. I., St. III., Stories, 1s.; No. II., St. IV., Early England, 1s.; No. III., St. V., Middle England, 1s. 4d.; No. IV., St. VI., Modern England, 1s. 6d.; No. V., St. VII., Standard Authors, 2s. 6d.

II. THE WHITEHALL HISTORICAL READERS. Each complete. St. III., Stories, 8d.; St. IV., Sketches, 10d.; St. V., Annals, 1s. 3d.; St. VI., Chronicles, 2s.; St. VII., Standard Authors, 2s. 6d.

III. THE 'ALBERT' HISTORICAL READERS. St. III., 60 Lessons, 1s.; St. IV., 60 Lessons, 1s.

N.B.—The Albert Historical Readers have been issued, and suit the exact conditions required by the Code, 1884-5, as to number of Lessons, etc. All Gill's Readers are most beautifully illustrated.

GILL'S VICTORIA ATLAS. 101 Coloured Maps, 1s. 'The cheapest and best Atlas in the world.'

GEORGE GILL & SONS, LONDON.

THE SCHOLASTIC SEWING MACHINE COMPANY.

SPECIAL REDUCTION.

Owing to the great success which we met with from fellow-teachers last year (1,132 machines were sold in seven months), we have resolved to offer another 'Special Offer' for a limited time.

We therefore offer a beautifully finished £4 4s. hand lock-stitch machine, by a well-known maker, for £2 14s. cash, or £3 on hire, carriage paid, repayable by eight monthly instalments of 7s. 6d. each, or by three quarterly payments of £1 each.

This machine is beautifully finished and ornamented in gold, and possesses the latest improvements to the present time. It has the patent shuttle and spool winder, which enables the person to wind the bobbins without the machine being set in motion. The extras given free are Bobbins, Needles, Screwdrivers, Oil and Oil Can, Double Hemmer, Braider, Quilter, and Illustrated Instruction Book. It is well made and most complete in itself, and in order that teachers may thoroughly test its abilities, we purpose sending every one of them on fourteen days' free trial; and if satisfactory, we wish it to be perfectly understood that the cash, or an instalment, must be paid at the end of the fourteen days' free trial. If not satisfactory it can be returned, and we are willing to pay the carriage both ways.

It is earnestly requested that when teachers are sending for a machine they will write their full name and address distinctly, stating the nearest Railway Station, as this will prevent unnecessary delay.

ABSTRACT OF TESTIMONIALS.

'The machine gives the greatest satisfaction. Very probably I may get some more orders for you.'—The Rev. J. C. THOMAS, The Vicarage, Duffryn, Neath, Glamorgan.

'The machine which I purchased two and a-half years ago still gives every satisfaction, and our best thanks are due to you for getting us one so cheap. In consequence I have been pleased to recommend you when possible.'—Mr. STOCKLEY, 24, Westcroft-square, Hammersmith, London, W.

'I can say that the machine which you supplied us continues to give entire satisfaction, and I shall be pleased to recommend it to my friends as a thoroughly sound machine.'—Mr. E. HOPKINS, Vine Cottage, 54, Aston-road, Birmingham.

'The six machines which I have purchased from you during the last three years, have proved excellent, both for work and finish, and I strongly recommend it to all teachers as a genuine article.'—Mr. E. HOWE, Board School at St. Keverne, Helston, Cornwall.

Particulars, Illustrated Lists, and Testimonials from the Manager,

2, AVENUE-ROAD, BOW, LONDON, E.

I have worn this Corset three days, and every bone over the Hips is broken.

I have worn the 'Flexible Hip Corset' three months, and every bone is still perfect.

BRITISH MUSEUM 26 MY 85

DR. WARNER'S PATENT
FLEXIBLE HIP CORSET

Being constructed after the analogy of the Human Form, is warranted not to break over the Hips. The bones in it pass like the Ribs around the Body secure a perfect fitting Corset, so comfortable that a lady can lie down with ease, so flexible that it yields readily to every movement, and yet so firm that it gives great support at the sides.

Black, Stitched Gold, 4/5; superior quality, 5/5; White or Drab, 5/6 post free. Post Office Orders payable to

S. AMERY, CLAPHAM RISE, LONDON, S.W

NEW SPRING DRESSES
FROM 5/11
12 YARDS

Patterns Free.

S. AMERY, 5 & 7, High Street, Clapham, London, S.W.

P.O. Payable at Clapham Rise.